COMPARATIVE ESTIMATE

OF THE

MINERAL AND MOSAICAL GEOLOGIES.

VOL. II.

A

COMPARATIVE ESTIMATE

OF THE

MINERAL AND MOSAICAL

GEOLOGIES.

REVISED, AND ENLARGED WITH RELATION TO THE LATEST PUBLICATIONS ON GEOLOGY.

ΣΥΜΦΩΝΟΝ ΔΕΙΝΑΙ ΤΟΙΣ ΦΑΙΝΟΜΕΝΟΙΣ ΤΗΝ ΤΟΥ ΘΕΣΠΕΣΙΟΥ ΜΩΣΕΩΣ ΚΟΣΜΟΓΕΝΕΙΑΝ.

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COMPARATIVE ESTIMATE, &c.

PART III.

OF THE MODE OF THE CHANGES OR REVOLUTIONS OF THE EARTH, ACCORDING TO THE MINERAL AND MOSAICAL GEOLOGIES, RESPECTIVELY.

CHAPTER I.

It is now finally decided, on a comparison of the *two geologies* with the philosophy of Bacon and Newton, respecting the FIRST great object of our inquiry, viz. *The* MODE *of all First Formations;* that philosophy and truth lie exclusively with the *Mosaical.* It remains for us, to institute a similar comparison with respect to the SECOND great object; viz. *the* MODE *of the universal Changes or Revolutions, which the mineral substances of the earth manifest themselves to have since undergone.*

But, a question here arises, with respect to the *course* by which this *ulterior object* ought to be pursued. In the former part of this disquisition, we began our investigation by examining the

pretensions of the *Mineral geology;* in order to bring it into a comparison with the *Mosaical,* and to try the validity of each by a *common test.* This object we have fully accomplished, with respect to the *first question;* and the result has been, a clear demonstration of the validity of the *latter* geology by the rule of that test, and of the invalidity of the *former.* This issue of our examination, appears to render it reasonable that we should now *alter our course;* and that, continuing to pursue the thread of the Record *thus far confirmed,* we should apply our close attention to what it relates concerning *Changes* or *Revolutions,* effected in the substance of this globe by the intervention of the same Power who alone acted in the work of *Creation:* carefully examining, at the same time, whether "the *phenomena* harmonise with the *history;*" whether the *evidences of revolution* which the earth reveals, correspond with the *statements of the record* and are sufficiently accounted for by it; or, whether the *mineral geology* has discovered the evidence and the statements to be *at variance,* or has found any evidences of revolution which are not reducible to those stated in the record; for, if they are all so reducible, if *the conditions, required by actual observations of the earth, are all thoroughly satisfied by the record,* then it will be equally contrary to philosophy and common reason, to assume any other revolutions upon a ground of mere *gratuitous conjecture.*

But, there is another reason, why this course is to be preferred for this *last part* of our inquiry, besides the superiority which the record has already acquired from the decision of the test in the first question; which is this: *physical philosophy*, for a long time past, had taken upon itself to deny the truth of the Mosaical statements, and often with much sarcasm, because it assigned a date of not more than about *four thousand years ago*, for the period of a Revolution which was able to cause *marine substances* to be imbedded in all parts of *this inhabited earth;* even in places the most remote from the sea, and in elevations very considerably above its present level. But, the progress of physical research during the last few years, conducted by naturalists of acute and honest minds, has at last terminated in so signal a concession to the testimony of the Mosaical record in this particular; that, added to the authority of Bacon's and Newton's philosophy, it renders that testimony *paramount*, as the *rule* by which all inquiries concerning *revolutions general to the globe* ought henceforth to be conducted. For, the *mineral geology* has been brought at length, by *physical phenomena* alone, to these conclusions; "*that the soils of all the plains were deposited in the bosom of a tranquil water; that their actual order is only to be dated from the period of the retreat of that water; that the date of that period is not very ancient*[1]; *and, that it cannot be carried*

[1] D'AUBUISSON, i. 252.

"*back above five or six thousand years*[1]." Dolomieu, Saussure, Pallas, De Luc, Cuvier, D'Aubuisson, and the most distinguished naturalists of the age, have coincided in these conclusions; to which they have been led by the evidence of various *monuments* and *natural chronometers* which the earth exhibits, and, which remain perpetual vouchers for the veracity of the *Mosaical chronology*, with respect to the epocha of the revolution which the *Mosaical History* relates[2]. "This, "then, (exclaims Pallas,) will be that *Deluge*, "of which almost all the ancient nations of Asia, "the Chaldeans, the Persians, the Indians, the "Tibetians, and the Chinese, have preserved the "memory; and fix the time nearly to the period "of the *Mosaic Deluge*[3]." Let us, therefore, pursue the thread of the history, until it brings us to the relation of the *Catastrophe* or *Revolution* in question.

[1] CUVIER, *Disc. Prél.* p. 134.—*Th.* § 34.

[2] M. de la Métherie, the celebrated physiologist who thinks he has at length ascertained that the earth was made of *air and infinity*, according to the oracular opinion of *Anaximenes*; (see above, vol. i. p. 10, note,) thus complacently soliloquises, in opposition to all these testimonies—"*no fact* "*proves that any general catastrophes have ever taken place in the surface* "*of the globe—aucun fait ne prouve, qu'il y ait eu à la surface du globe* "*des catastrophes générales.*" *Journal de Physique*, tom. lxxx. p. 46.

[3] *Observ. sur la Form. des Montagnes*, p. 47.

CHAPTER II.

THE first act of Almighty God after the work of *Creation* was completed, and when, by the formation of a female, He had provided for the perpetuation of the race of man under the sacred bond of *matrimonial union*, was to prescribe a *moral rule* to those highly favoured beings whom His goodness had called to a happy existence; and, to whom He had granted the "DOMINION" over His earthly system, *in subordination only to* HIS OWN SUPREMACY. For that purpose, and in perpetual evidence of that *subordination*, He reserved, and prohibited, *one* and *only one* object out of the *universal grant;* the reservation and prohibition of which, though trivial in itself, was amply sufficient for the *end* designed, which was, to prove whether the *moral being*, thus bountifully endowed, acted with a due sense of *his subjection*, or whether he aimed to act *in chief*, and without respect to his divine Sovereign and Benefactor. That slight and solitary privation, was imposed on the declared principle of divine judgment—"*He who is faithful* "*in that which is* LEAST, *is faithful also in much;* "*and he who is unjust in the* LEAST, *is unjust also* "*in much*[1]." Under that trial, MAN *failed;* he

[1] Luke, xvi. 10.—"*Primordialis lex* est data Adæ et Evæ in paradiso, "quasi *matrix omnium præceptorum Dei.*" TERTULLIAN, *adv. Judæos*, cap. ii.

was found "*unfaithful in that which was* LEAST;" he was therefore ejected from the state of happiness, of which a *perfect obedience* was rendered the *indispensable condition;* he fell—and, in his fall, brought down *a* CURSE *upon the* NEW EARTH from its offended Creator.

At the expiration of 1655 years, the principle of *disobedience* which had been introduced by the first created man, had spread its destructive influence through the whole race of his descendants, *one family* alone excepted; and, this enormous disproportion between *obedience* and *disobedience,* by which "*God saw that the wickedness of man was great in* "*the earth, and that the imagination of his heart* "*was only evil continually,*" caused Him "*to re-*" *pent that He had made man,*" and to determine upon his "*destruction.*" Therefore, God said to Noah, who alone had "*found favour in His sight;*" —"*I will destroy* MAN, *whom I have created, from* "*the face of the earth; both* MAN, *and* BEAST, *and* "*the creeping thing, and the fowl of the air; for it* "*repenteth* ME *that I have made them: the* END OF "ALL FLESH *is come before* ME. *Because* THE "EARTH *is filled with violence through them, behold,* "MOREOVER, *I will destroy* THEM TOGETHER "WITH THE EARTH!"—καιρος παντος ανθρωπου ηκει ενωπιον μου. Ὅτι επλησθη ἡ γη αδικιας απ' αυτων, ΚΑΙ ἰδου εγω καταφθειρω ΑΥΤΟΥΣ ΚΑΙ ΤΗΝ ΓΗΝ[1]—"*I will destroy* THEM AND THE "EARTH." Such is the exact interpretation of

[1] Gen. vi. 13.

the *terms*, in which God pronounced His irreversible decree.

The *execution* of this tremendous threat, produced that *universal revolution* of the globe which the historian proceeds to relate; it is, therefore, of the utmost consequence, that we should apprehend correctly the *import of the threat*, before we proceed to investigate the *details and evidences of its execution*.

The *climax* of the threat, is awfully remarkable: "I will destroy *man*:—I will destroy *man* "*and beast*:—I will destroy *all flesh*:—I will "moreover destroy *all flesh* TOGETHER WITH THE "EARTH!" But, the reason of this final clause will be found declared in the text, if it be correctly rendered, and punctuated: "*because the* "*earth* is replete with wickedness through them, "(*therefore*) I will destroy them *together with the* "*earth*." The construction of the original is exactly the same as in chap. iii. 14 and 17, "*be*-"*cause* thou hast done this, (*therefore*) thou art "cursed above all cattle:—*because* thou hast "eaten of the tree, (*therefore*) cursed is the "ground."

The *sum* of the threat, is comprised in the last clause, הנני משחיתם את הארץ—"*I will destroy* "THEM, (i. e. *all flesh*) *together with* THE EARTH:" the correct interpretation of which important passage, depends upon the true and proper sense of the Hebrew particle את.

If we look into the "*Concordance of the He-*

" *brew Particles,*" we shall perceive, by a general view, that the *most frequent* signification of this particle is that of *cum, und cum—with, together with.* In this sense it was understood here by the *earliest interpreters,* who render it, εγω καταφθειρω αυτους ΚΑΙ την γην—" I will destroy them, " *and* the earth ;"—" *and* the earth," being equivalent to " *with* the earth," and confirming and enforcing the *conjunctive* signification: as in the Latin, the preposition *cum* is often used for the conjunction *et*[1]. The Chaldee paraphrase, and both the Targums, likewise interpret it in the same sense: " ego disperdam eos *cum* terra—I " will destroy them *with* the earth ;" which interpretation Aben Ezra thus lucidly paraphrases, " perdam eos, ET *perdam terram*—I will destroy " them, AND *I will destroy the earth.*" This, therefore, was the established interpretation of the passage in the ancient Jewish church.

But, there must have been a *sufficient cause,* for this *uniformity of interpretation* of the particle את by the ancient Hebrews; which *cause,* could be no other than the *traditional sense* with which the passage had been uniformly transmitted through their generations. What that *traditional sense* was, is distinctly declared by the apostle St. Peter; who, adverting in his second epistle[2] to the *catastrophe of the deluge,* expressly affirms, that " *the world which then was, being overflowed*

[1] GESNER's *Thes.* col. 1309, 10. [2] 2 Peter, iii. 6, 7.

"*with water, perished*"—ὁ τοτε κοσμος, ὑδατι καταχλυσθεις, απωλετο: by which word κοσμος—*world*, he intended the *then inhabited earth*, as he plainly shews in the chapter immediately preceding; where he affirms, that "God brought the "*flood* upon the *world* of the ungodly"—κατακλυσμον κοσμῳ ασεβων επαξας[1]. To the τοτε κοσμος—*world* or *earth which* THEN WAS, St. Peter opposes, ἡ νυν γη—*the earth which* NOW IS; and he proceeds to declare, that "the earth which "*now is*, is reserved for destruction by *fire*," *as* the earth which *then was*, suffered destruction by *water*. He thus enables us to judge of the *extent* of the destruction of the *former earth*, by affirming the destruction of *both earths* to be *equal;* and therefore, rendering them *rules* for mutually explaining each other. Of the *latter*, we are apprised that its destruction by *fire* will be *final;* and we are therefore, in consistency, to infer of the *former*, that its destruction by *water* was also *final:* the *instruments* of destruction are different, but their *effects* are coextensive, according to the diversity of their operations. So that the sense in which the ancient Hebrew interpreters understood the words "*and* or *with the earth*," is thus both expounded and confirmed, by the highest authority in the Christian church. And, in the same obvious sense, the words of St. Peter were

[1] 2 Peter, ii. 5.

understood by St. Augustin: "He has, indeed, "(says that learned Father,) said enough con- "cerning the destruction of this world: and "also, where, in commemorating the deluge "before transacted, he seems in a manner to ap- "prise us, how we are to believe that this world "is to perish at the end of time. For he says, "that at that time—the *body of the earth* perished "by the Word of God. But, the heavens and "the *earth* (says he) which *now are*, are kept in "store by the same Word, reserved for fire.— "Wherefore, *this world which was substituted for* "*the world that perished in the deluge by the water*, "is reserved for the final fire at the day of judg- "ment[1]."

We have another, very ancient and very remarkable, testimony to the same point of traditionary evidence, in the book of Job; where we read —"Hast thou marked the *old way which wicked* "*men trod*, who were cut down before their time,

[1] "Dixit sanè de perditione mundi hujus satis: ubi etiam comme- "morans factum ante diluvium, videtur admonuisse quodammodo, qua- "tenus in fine hujus seculi mundum istum periturum esse credamus. "Nam et illo tempore *perisse dixit — orbem terræ.* — Qui autem *nunc* "*sunt*, inquit, cœli et terra, eodem verbo *repositi sunt*, igni reservandi.— "Proinde, *qui mundus, pro eo mundo qui diluvio periit ex eadem aqua, repo-* "*situs est, ipse* igni novissimo reservatur, in diem judicii." (AUGUSTINI *de Civitate Dei*, lib. xx. cap. 18.) Here it is manifest, that this learned Father understood the Scriptures to declare, that the earth we now inhabit is a *different earth* from that which was trodden by the antediluvian generations.

" *whose* FOUNDATION *was destroyed by a flood of* " *waters*[1]*?*" Vatablus here comments: " hoc est; " visne tueri opinionem illam antiquorum qui per- " ierunt *tempore Diluvii?*"—wilt thou follow the " opinion of that ancient race, which perished in the " *time of the Deluge?*" The Greek interpreters, in varying the import, tend to increase its force; for they render it, " *their* FOUNDATIONS (*are become*) *an overflowing flood*"—ποταμος επιρρεων οι θεμελιοι αυτων. To the same point is the rendering of the old Latin version: " *fluminis decurrentis* FUNDAMENTA " *eorum.*" Schultens translates, " *flumen fusum* " FUNDAMENTUM *eorum:*" The original of this notable passage, נהר יצק יסדם, Michaelis interprets, " *fluvius eluit* FUNDAMENTA *ipsorum—a flood obli-* " *terated their* FOUNDATIONS;" and he subjoins this observation: " The thread of the discourse, " appears to demand this interpretation; which " indeed the Vulgate has anticipated, by rendering " the passage, '*fluvius subvertit* FUNDAMENTUM ' *eorum—a flood overturned their* FOUNDATION.' " This authority is not to be slighted; since " Jerom, when he translated the book of Job, fol- " lowed the guidance of his Rabbin of Lydda; " who, as he affirms in his preface, was accounted " the first among the Hebrew scholars[2]."

The word נהר, which is here rendered *fluvius —flood*, denotes, not only great rivers, as the Tigris and Euphrates, but likewise the *collective*

[1] Job, xxii. 16.

[2] *Suppl. ad Lex. Heb.* no. 1036.

mass or *flood of the sea*. So it is used in the Psalms: "The earth is the Lord's: He hath founded it "upon the *seas*, He hath established it upon the "*floods*—נהרות[1]." So also in the prayer of Jonah: "Thou hast cast me into the *deep*, into the heart "of the *seas*; and *the floods*—נהר[2]—compassed "me about." The word יסד—foundation, denotes the lowest base of support necessary to sustentation. The destruction of a FOUNDATION, in the language of Scripture, signifies *utter destruction*. Thus, the same ancient writer: "*whose* FOUNDATION *is* "*in the dust—they are destroyed—they perish toge-*"*ther*[3]?" And Isaiah: "*the* FOUNDATIONS *of the* "*earth*, מוסדי, *do shake, the earth is utterly broken down* "*—it shall fall and not rise again*[4]." With regard to the sense of the verb יצק, Michaelis defers altogether to Jerom's learned Rabbin; who has expounded it to signify, *subvertit — overthrew, destroyed*. The author of the book of Job, therefore, affirms; *that the waters of the* FLOOD *destroyed, not the wicked race themselves only, but also, the* FOUNDATION *of the dwelling on which they had existed;* which exactly coincides with the words of St. Peter, καταχλυσμον ΚΟΣΜΩι ασεβων επαξας—"*bringing a flood upon* "THE WORLD of the *ungodly*."

The same ancient author adverts pointedly, in another place, to the *two* vast operations; by which, God *made the earth dry*, and afterwards *submerged it*. Speaking of the irresistible power and wisdom

[1] Psalm xxiv. 2.
[2] Jonah, ii. 3.
[3] Job, iv. 19, 20.
[4] Is. xxiv. 18, 19, 20.

of the Almighty, he appeals to *facts*: "*Behold*, "*He withholdeth the waters, and* THEY DRY UP; "*also, He sendeth them forth, and they* DESTROY "THE EARTH[1]:" or, as the Greek renders it: "*If* "*He restrain the water, He* MAKETH THE EARTH "DRY; *if He impel it, He maketh it return, and* "DESTROYETH IT." This passage cannot be *critically* explained, otherwise than by reference to those *two great historical facts*. It is against all just criticism, to *generalise from one particular*; and there is only *one instance* upon record, of God having *made the earth dry* by restraining or withdrawing the waters, and having *destroyed it* by bringing them back upon it[2]. And, since the same author, as we have just seen, has cited the latter

[1] Job, xii. 15. εαν κωλυσῃ το ὑδωρ, ξηρανει την γην· εαν δε επαφῃ, απωλεσεν αυτην καταστρεψας.

[2] It is more than probable, that the Aristotelian doctrine of *periodical* interchanges or alternations of *land* and *sea*, originated in a similar *generalisation* of the *particular facts* traditionally, but vaguely, transmitted. According to the genuine tradition,—εις θαλασσαν την ηπειρον μετεβαλε (ὁ Θεος)—"God *changed the land into sea*," says Josephus. Nothing more was wanting, than the *generalising disposition* to which we are so prone when we are in ignorance of a subject, to extend the tradition of this *particular change*, after that of the first *refusion of the abyss*, into the general proposition of Aristotle—τα περι την ηπειρον μεταβαλλει και την θαλατταν. και ουκ αει τα μεν γη τα δε θαλαττα διατελει ταυτα τον χρονον· αλλα γιγνεται θαλαττα μεν ὁπου χερσος, ενθα δε νυν θαλαττα παλιν εντανθα γη· κατα μεντοι τινα ταξιν νομιζειν χρη ταυτα γινεσθαι και περιοδον—(*Meteor.* i. 14.) "these causes *change the continent and the sea*. For, the same parts do "not always continue *land* and *sea*; but, that which was *dry land* becomes "*sea*, and again, that which is now *sea*, becomes *earth*. We *ought to sup*"*pose*, that this happens *according to a certain order and periodical revolu*"*tion*:" of which *certain order and periodical revolution*, there exists no evidence, either *physical* or *moral*.

great event in another place, the passage before us ought to be received with allusion to the same.

From not having looked thoroughly into this subject, most modern commentators have revolted at the *primitive interpretation* of the passage in Genesis which we are now considering; and, without inquiring into the *cause* of its adoption, have only endeavoured to *give* to the passage a sense that should be clear of the import which perplexed and offended them. But, *sound criticism* does not consist in *giving* a sense, but in *receiving* a sense. "The moderns," says the learned Hebrew grammarian Drusius[1], "read *à, è, de—from*, or *off* "*from;* but, I conceive, *incorrectly—dubito an* "*bene.*" And with good reason, for it is a *forced* interpretation; the particle את occurring only *once* in each of those significations in the book of Genesis, but about *fifty times* in its familiar sense of *cum, unà cum—with, together with;* in which sense it is employed above *two hundred and fifty times* in the Hebrew volume. The very learned Noldius, from not having apprised himself of the true state of the historical *question*, objects to the sense of *cum—with*, upon the ground of its not being applicable

[1] Drusius, interprets את as equivalent to עם—*cum*, (*in Ecclum.* i. 12. not.) of which latter word he observes (v. 8. not.), "in Ebraismo aliquando "עם, id est *cum*, pro *et* usurpatur."—"DRUSIUS, ou *de* DREISCHE, Pro- "fesseur en langue Hébraique dans l'Académie de Frise. Il a été en "réputation vers la fin du XVI siècle. C'est avec beaucoup de raison "qu'il passoit pour un des plus habiles de son tems dans la connoissance "de la langue sainte, ce qui lui fit donner le nom de *Divin Gram-* "*mairien.*" *Dict. de* MORERI. Amst. 1702.

for expressing the destruction *only of the productions* of the earth; for, says he—"*terra diluvio* "*non fuit perdita quoad substantiam, sicut homo*— "*the earth was not destroyed by the deluge with respect* "*to its substance, as man was*[1]." But, in this remark, he only shews that he was unaware of the *fact* which we have ascertained—that the ancient Jewish church understood the *reverse* of what he assumes; namely, that the *substance*, not only of *man* but also of the *then subsisting earth*, perished in the deluge: as the same is expressly declared and confirmed by the authority of St. Peter. Drusius, from the same cause, reduces himself to the same perplexity: "*An ille alius mundus ab eo qui* "*nunc est? Quoad substantiam, unus et idem est;* "*quoad qualitatem, fortasse aliqua est diversitas*— "*Was it a different world from that which now is?* "*with respect to substance, it is one and the same;* "*with respect to quality, there is perhaps some dif-* "*ference.*" In thus replying to his own question, he has embroiled himself, by not distinguishing between the *entire globe* of the earth, and the *particular portion of its surface* provided for the habitation of the antediluvian races; in which *distinction*, will be found the "*difference*" which he questions. But, the true import of the terms, stands confirmed by every consistency of criticism; and, can only be rejected through *inconsideration*, or on a ground of *preconceived hypothesis*. Not only did God, *before the flood*, pronounce; "I will

[1] *Concord. Heb.* p. 797, no. 599.

" destroy them *together with* the earth;" but, *after the flood*, He declared; " NEITHER *shall all* " *flesh be cut off any more by the waters of a* " *flood;* NEITHER *shall there any more be a flood* " TO DESTROY THE EARTH[1]:" thus emphatically affirming, and distinguishing, the *destruction of* EACH. And, the last mysterious clause of this divine assurance, is unfolded in the inspired declaration of St. Peter; " *the earth which* NOW IS, " *is reserved unto* FIRE."

Such, then, being the consentient understanding of all those principal Hebrew authorities, it establishes the *terms* of the threat, to signify — *the destruction, not only of man and of all the animals which coexisted with him, but* LIKEWISE, *of the very* EARTH ITSELF *on which they had hitherto inhabited.*

Nor, ought this interpretation to embarrass, or in any way to surprise us; for, let us remember, that the *then subsisting earth*, received the denunciation of a *curse from God* at the moment when the first act of disobedience was committed upon it; and, " *that which is* CURSED *of Him shall be* " CUT OFF[2]." It ought to be carefully noticed, that the *curse* was not pronounced upon *man*, but, upon *the earth on his account*[3]. The subsequent judgment of *destruction by a deluge*, which eventu-

[1] Gen. ix. 11. *ουκ ετι εσται κατακλυσμος καταφθειραι πασαν την γην*— as before, *εγω καταφθειρω αυτους και την γην*: their *earth*, suffering equal destruction with *themselves*.

[2] Psalm xxxvii. 22.

[3] Gen. iii. 17.

ally followed, involved them both; but, the *curse*, pronounced immediately after the *fall*, fell not upon *man*. A heavy *punishment*, indeed, was then denounced against him; but, that punishment was far removed from a *curse*, because, the assurance of an *infinite blessing* accompanied the denunciation[1]. The *Earth alone* was the subject of the *curse*[2]. But, though its productions were accordingly affected, yet, the *full consequence* of the curse appears evidently not to have been limited to that actual affection. Even until the birth of Noah, that malediction seems to have carried forward the prospects of the pious to *some crisis*, by which it would be *terminated*. On that occasion his father was led (no doubt by some inspired warning) to exclaim: "*This child shall* "*comfort* US *concerning our work and toil of our* "*hands, because of the earth which the Lord hath* "*cursed*[3]:" so our common English version; but, the Greek interpreters render their text with a very observable difference: "*This child will cause* "US *to cease from our toil, and from the distress of* "*our hands,* AND FROM THE EARTH WHICH THE "LORD HATH CURSED!"—*οὗτος διαναπαύσει ἡμας*

[1] Gen. iii. 15.

[2] "Propter hoc et in initio transgressionis Adæ, sicut enarrat Scrip-"tura, non *ipsum* maledixit *Adam*, sed *terram in operibus ejus*: quemad-"modum ex veteribus quidam ait—'quoniam quidem transtulit Deus 'maledictionem *in terram*, ut non perseveraret *in homine*.'" IRENÆUS, *contra Hæres.* lib. iii. cap. 23, ap. ROUTH, *Reliq. Sacr.* tom. i. p. 43.

[3] Gen. v. 29.

απο των εργων ήμων, και απο των λυπων των χειρων ήμων, ΚΑΙ ΑΠΟ[1] ΤΗΣ ΓΗΣ ΗΣ ΚΑΤΗΡΑΣΑΤΟ ΚΥΡΙΟΣ ὁ ΘΕΟΣ. In which word "US," we are not to understand *themselves personally*, but their *family and race*. And, after the retreat of the waters of the deluge, God did not *revoke* the curse which He had formerly pronounced, because it had been fully executed in "*cutting off the* "*cursed thing*;" but He declared, that He would not *again pronounce a curse*, that is, *a second curse*, upon the earth,—the *new earth*, which He had provided to succeed that which had been *cursed* and *cut off*: ου προσθησω ετι καταρασθαι την γην —"*non addam maledicere rursus terram*:" which implies, that *the curse was terminated by the deluge*. Neither is there any mention in Scripture of a *general curse upon the earth*, except, 1. when it was originally pronounced to Adam; and finally commemorated at the birth of Noah. 2. when God, after the flood, declared that He would not curse the earth a *second time*. 3. when a warning is given in Malachi, not to provoke a curse upon the earth.

But, if that *first earth*, which had been brought to light on the third day of the creation *by the removal and drainage of the waters that covered it*, perished indeed, according to the curse of God, in the catastrophe of the *Deluge;* what was that *second earth*, on which the Ark was brought to its

[1] It is evident, that the Heb. copy of the LXX. read ידינו ומן-ארמה.

rest by His favour and providence, and which has continued to be the abode of the generations of mankind, from the time of Noah to the present day? From *whence* did it derive its *origin?*

And, is it possible that *we* can find any difficulty in resolving this question to ourselves, who have the record open before us; and who have seen, *how that first habitable earth was brought to light?* We cannot fail to perceive; that a *repetition of the same process, a renewal of the same divine operation* which produced the *former earth,* was alone requisite to bring to light *another earth to replace it,* now that the counsels of its Creator had determined to *remove it.* We have already seen, that, in the *first great revolution* or *modification* of the primitive formation of our globe, which took place in the *third day* of the progress of Creation, *one vast division* of its subaqueous surface was suddenly and violently fractured and depressed, in order to form *a bed* sufficiently profound to receive and confine the congregated waters of the universal abyss; which waters, drawn down into that bed from off the *other division* of the subaqueous surface, left it exposed, undisturbed, and fitted for the growth of vegetation and the habitation of animals and of man. That exposed, and hitherto undisturbed division, was now to sink and disappear. By a *similar* fracture and depression of its surface, which should reduce it below the level of the *first depressed part* or *basin of the sea,* the waters, flowing down into a *still lower*

level, would leave that basin *empty*, *exposed*, and *dry;* and would thus render it, in its turn, an *habitable earth*, applicable to all the same uses as the former earth which had been obtained by a *similar drainage of the waters*[1]. We are enjoined by sound philosophy, to refer similar effects to similar causes; and, the *effects* which we are considering being in both cases *similar*, we are accordingly to refer them to *similar causes*. And, since the record contains nothing that opposes the application of this principle to the case in question, we are authorised by reason to conclude; *that the production of a* SECOND EARTH, *was effected by means exactly corresponding to those which had produced a* FIRST EARTH: the evidence, which the mind is enabled to apprehend, of the *means* by which *a first earth* was produced, becoming conclusive evidence to the reason, that a *second earth* might be produced by *similar means*, and therefore, directing it *to look to those means for its production*. Among those *means*, or *secondary agencies*, we have found the strongest reasons for assuming the instrumentality of *volcanic action*[2].

[1] "If we suppose the present continents to have been included in the "channel of the primitive ocean," argues an able mineralogical writer, "we *must* suppose them to have *gradually emerged thence* during the "period between the creation and the deluge."—(CONYBEARE, *Geol. of England*. Introd. p. lix.) I beg leave to deny the *necessity;* we have no historical testimony of the *gradual emergation* of continents, but we have positive historical testimony of their *sudden exposure*, by *depression* and *drainage of the waters of the ocean*.

[2] See above, vol. i. p. 217, 218.

That powerful agency, rendered extensively operative at two successive and distant periods, would probably have left correspondent and permanent vestiges of its operation, during both those periods, in the materials of the crust of the globe; and accordingly, the mineral geology has found, that, in some regions of the earth, "the principal "seat of the subterraneous fires appears to be be- "neath the transition or *fragmentary rocks*[1];" that is, beneath those rocks which were *first fractured* to form the primitive *sea-bed;* whilst, in other regions, "the volcanic formations appear "to have been formed between the epochas of "the *secondary and tertiary* formations[2];" that is, between the last tranquil *sedimentary* formations in the primitive sea, and the tumultuary formations during the *diluvial transfusion* of that sea.

[1] HUMBOLDT, *Superpos. of Rocks*, p. 33. [2] Ib. p. 416.

CHAPTER III.

THUS, then, from the *terms* of the divine menace, and from the *concurring testimony* of the ancient Jewish church, we are to conclude by *critical induction*, antecedently to all minute investigation of *monuments* or *phenomena*; that it was the determination of Almighty God to destroy, *not only man and every living creature*, but likewise, THE EARTH ITSELF: that EARTH, upon which He had pronounced His CURSE. To give effect to this tremendous design of His counsels, the order of things which He had established was to undergo a temporary suspension and alteration; and, His Almighty agency was to resume an *immediate operation*, in the works of His terrestrial creation.

By a new exercise of His incomprehensible power, and by a new direction of the instruments and agencies which He had provided, He caused the irruption of violent inundations, sufficient to commence the work of destruction, and, at the same time, to raise and float the Ark from the station on which it had been constructed; the direction of which fabric, was thenceforth taken under the immediate care of His own divine providence. Vast causes were put in action, and vast effects produced, which are expressed generally in the record, by "*the fountains of the great deep being*

"*broken up*," and "*the windows of heaven being* "*opened*;" phrases, which plainly imply, the *inroad of the sea upon the land*, and the *descent of violent rains from the heavens*.

But, here it is asked by the mineral geology; "*to what purpose a rain of forty days, to overwhelm* "*a continent that was to be immersed under a whole* "*ocean*[1]?" Doubtless, if the immersion of a continent under an ocean, as a *mere physical effect*, was the whole design of the revolution of the *deluge*, a rain of forty days was a very superfluous agent. But, since the *chief end* to be attained by the operation was not a *physical*, but a *moral* end, and, since the *physical effect* was wholly subservient to that *moral end*; the *rain of forty days* was a necessary, and a most efficient agent. The condemned race of mankind, were to *witness the progress* of the vast scheme of destruction which their wickedness had provoked. They were to be taught *experimentally*, that their place of habitation was passing away from them, and was no longer to remain a dwelling accommodated for the service of animal life; that it was at length to receive the *consummation of the curse*, pronounced at the disobedience of their first parent, and confirmed by the divine foreknowledge of their incorrigible wickedness. They were to be *terrified* by the sight of the various instruments of vengeance, by which the power of God was able to *execute*

[1] KIRWAN'S *Geol. Essays*, p. 63.

His curse; and, they were to *foretaste destruction*, in every stage of its advance, until its actual and ultimate arrival. They were "*to call upon* "*the mountains to cover them, and upon the hills to* "*fall on them!*" Great, therefore, was the purpose, and equal must have been the effect, of the terrific prelude of a *rain of forty days*, and of all the accompaniments of horror which attended it; which are thus awfully represented by the learned Jew Philo, either by reasonable inference, or (which is more probable) from *national tradition*: "The vast ocean (says this writer) being "raised to an height which it had never before "attained, rushed with a sudden inroad upon the "islands and continents. The springs, rivers, "and cataracts, confusedly mingling their streams, "contributed to elevate the waters. *Neither was* "*the air quiet; dense and continuous clouds covered* "*the whole heavens; violent hurricanes, thunders,* "*and lightnings, were blended with unintermitting* "*torrents of rain;* so that it seemed, as if all "parts of the universe were resolving themselves "into the *single element of water:* until, the fluid "mass having at length accumulated from above "and from below, not only the lower lands, but "even the summits of the highest mountains, "were submerged, and disappeared. For, *every* "*part of the earth sunk beneath the water*—εδυ καθ' "ὑδατος—*and the entire and perfect system of the* "*world*—ὁ κοσμος ὁ παντελης και ὁλοκληρος—*be-* "*came* (*what it is not lawful either to speak or to*

" *think*) *mutilated, and deformed by a vast* AMPUTA-
" TION!"—ακρωτηριασθεντα μεγαλῳ ΤΜΗΜΑΤΙ λελωβησθαι[1].

But, (it has been asked,) what was the *cause* which *first* put these powerful agents in motion? " If we would discover the *cause* of this cata-
" strophe, (says the mineral geology,) we must
" look for *a cause foreign to our globe, foreign*
" *to the whole solar system, capable of inundating*
" *continents, and giving to the waters of the deep*
" *unexampled impetuosity.*" This is most truly observed; but, wherefore does it subjoin—" *this*
" *is a point on which I forbear to give any opinion*[2]?" Is it, upon the same principle on which De Luc would abstain from introducing the mention of *creation* in a treatise of *physics*[3]? The opinion which Newton would have given, without an instant's hesitation, respecting *such a cause as is here described,* is fully evidenced by the general tenour of his arguments in his *Letters to Bentley.* Since he ascribed the *tendency of the sea towards the equator,* to the laws of planetary motion; and since he ascribed the *first impulse* of that planetary motion, to " the *Divine Power,* the *Divine*
" *Arm,*" *immediately*[4]; he would have deemed it unphilosophical, and irrational, to ascribe the *first impulse* determining that *preternatural action of the waters,* to any other cause than the same " *Divine*

[1] PHILO *de Abrahamo*, p. 7.
[2] GREENOUGH'S *Geology*, p. 196, 8.
[3] See above, vol. i. p. 59.
[4] *Letters to* BENTLEY, 1, 2, and 4.

"*Power*," the same "*Divine Arm.*" This was, assuredly, the only "cause *foreign to our globe* "*and solar system*, that was capable of giving "to the waters of the deep their unexampled "impetuosity." And, since we have no reason whatever for supposing that a similar catastrophe can ever occur by the operation of any known laws of nature, and since we are assured, by the Author of those laws, that it never shall occur again, Newton would not have wasted a moment in searching for the cause by which it was produced; but would have concluded, here as elsewhere, "certainly that which can never be "*hereafter* without a supernatural power, could "never be *before* without a supernatural power[1]."

An eminent French mathematician, however, deprives himself of this consolation, by choosing to *doubt* of "*the nature of the stability of equilibrium* "*in the sea*;" and he propounds, "that there is "*reason to fear*, that some *extraordinary cause* may "communicate to the sea a concussion, which, "though inconsiderable at first, *may* increase "more and more, and raise it above the highest "mountains; *which* (he observes) *would explain* "*many phenomena of natural history*[2]." Until, however, he shews *reason for doubting* the stability of equilibrium in the sea, we certainly have *no reason to fear* that calamity; and Moses and

[1] *Fourth Letter to* BENTLEY.

[2] LA PLACE, *Systême du Monde*, chap. ii. p. 265.

Newton concur to relieve us from all doubt. Neither need we wait for that event, to enable us to explain the "*phenomena of natural history*" to which he so plainly alludes; for, we have already ascertained, both the "*extraordinary cause*" which alone could effect such a revolution of the sea, and also, the nature of the revolution which was actually effected by that cause; and, therefore, we are already in possession of the means for explaining the phenomena which were occasioned by that revolution.

By the continued action of the powerful agents thus employed by God, His awful purpose was at length fully effected; namely, the destruction of "*every living thing of all flesh, clean and un-*" *clean,*" (excepting only those few individuals which were destined to keep seed alive upon the earth,) "*together with* THE EARTH ITSELF," on which they had subsisted. Meanwhile, the ark and its inhabitants, guided throughout all this period of devastation by the particular providence of God, obtained at length a lodgment upon a solid base; which, after the waters had entirely subsided, and were a *second time* "*gathered together* "*into* ONE PLACE," proved to be the summit of a mountain on the *new earth*, which was afterwards denominated *Ararat*, in the region of ARMENIA. "Listen!" (says St. Chrysostom,) "the "Deluge, was the common wreck of the in-" habited land; the cataracts were opened, the "abyss flowed out again, and every thing was

" water: the visible things were *resolved into* " *their elements*; earth no longer appeared, for all " was sea.—Behold now a miracle! When " the *earth had been obliterated*, when those " who had worked wickedness were exterminated, and when the tempest had subsided, the " summits of the mountains appeared;—the ark " rested; its doors were opened; and Noah went " forth, preserved from the wreck. He beheld " the earth desolated; he beheld a tumultuary " sepulchre, the mud, a sepulchre common to " beasts and men; all the carcasses, of horses, " and of men, and of all unintelligent animals, " imbedded in the same tomb. He beheld that " tragedy!—All had perished; neither man, nor " beast, nor any other of the things that were " without the ark, was preserved; he beheld " *heaven only* (the same)[1]!"

The time allotted for the completion of this amazing revolution, was *twelve months;* during

[1] Ακουε. εγενετο κατακλυσμος το κοινον της οικουμενης ναυαγιον· καταῤῥακται ηνεῳχθησαν, και αβυσσοι ανεβλυσθησαν, και παντα ην ὑδωρ· και τα φαινομενα ανεστοιχειουντο· και γη ουκ εφαινετο, αλλ' ην παντα πελαγος.—Και ορα θαυμα· ὁτι εξεκλυσθη ἡ γη, ὁτι ανηρεθησαν οἱ τα κακα ειργασμενοι, ὁτι ελωφησεν ὁ χειμων, εφαντησαν αἱ κορυφαι των ορεων·—καθισεν ἡ κιβωτος, και ανεῳγησαν αἱ θυραι. εξηλθε Νωε, εκ των ναυαγιου διασωθεις· βλεπει την γην ηρημωμενην· βλεπει ταφον ισχιδιασμενον, ιλυν, ταφον κοινον κτηνεσι και ανθρωποις, παντα ὁμου τα σωματα ἱππων, και ανθρωπων, και κτηνων αλογων παντων κατακεχωσμενα. Ειδε την τραγωδιαν εκεινην. παντες απωλοντο· ουκ ανθρωπος, ου κτηνος, ουκ αλλο τι των εξω της κιβωτου διεσωθη, ουρανον εβλεπε μονον.—S. CHRYSOSTOM. tom. i. p. 782, 3.

which period, as Josephus speaks, "*God changed* "*the continent into sea*" — εις θαλασσαν την ηπειρον μετεβαλε. But, that the transfer of the waters from the *old* into a *new* bed was not *immediate and simultaneous*, as, when they were congregated in the former bed on the third day of creation; on the contrary, that it was conducted with much *gradation* and *calculable succession;* is evident, both from the time employed in the process, and from the description of the record. And, here we must observe; that the historian, having notified in the *terms* of the divine threat the *fact* of the *destruction of the* EARTH, proceeds, as in his narration of the *Creation*, to describe the progress of the catastrophe *practically and optically*[1], as the *effects* would have appeared to the *eye of the spectator;* and it is for us to refer those effects to their proper causes, by principles of reason exercised upon their appearances in *this case*, as in the *former case;* and to deduce from them such conclusions, as that *optical description* is justly qualified to yield.

It is not possible, to apprehend correctly the description afforded us of that vast operation which our version renders, "the *fountains* of the great "deep were *broken up*," without resorting to the original text, and investigating the precise meaning of its terms. The original text is this—נבקעו כל מעינות תהום רבה. The word מעין, *fons*,—*foun-*

[1] See above, vol. i. p. 162, 163.

tain, is thus accurately expounded by Simon: "propriè, vi formæ, *locus ubi* aqua fontis pro-"fluit — this word properly signifies, by virtue "of its formation, *the place where* the waters "of a fountain issue forth." This is also the proper meaning of the Latin *fons*, from which we have derived our word *fountain:* Varro expounds it in almost the same words as Simon — "Fons, *unde funditur* à terra aqua viva — the "*place from which* a running water is discharged "from the earth:" (*funditur*, i. e. *à fundo datur*[1].) The מעין, *fons, fountain* of the great deep or abyss, will therefore correspondently signify — "*locus*, "*ubi* aqua abyssi profluere conatur — the *place*, "*where* the congregated waters of the abyss '*toss and roar*,' in their efforts to '*surpass their* '*bounds*,'" in other words, the *sea-bed*, ים; which word, denotes the *bounded receptacle* in which the abyssal waters are congregated together. We are expressly told, that the *sea*, ימם or ים, *iam*, does not denote the *waters*, considered in themselves; but, only with relation to their *receptacle*, when they are *so collected* as to leave the adjoining land *dry above them*. Hence, the *waters*, and the *sea*, are continually distinguished in Scripture; the *sea*, denoting the *place* in which the *waters* subsist[2].

[1] Thus, when Virgil says, "Nereus ciet æquora *fundo*," the *fundus æquoris* is the *fons æquoris* — the *fountain* or *bed of the great deep*.

[2] Isaiah, xi. 9. Hab. ii. 14, "full, as the *waters* cover the *sea*, i. e. "their *bed*."

That *place*, in all its component *parts* or *places*, נבקע, was "*broken up* or *disruptured*." Now, that *place* had been originally formed, by *disruption*, within a portion of the crust of the globe; and therefore, the *disruption of the place*, can only have relation to that which constituted it *a place*, namely, the earth or land by which it was circumscribed and configurated. By the disruption of that *place*, therefore, the waters were *extended beyond their first limits*, even as far as the *new disruption* extended those limits; so that, from the commencement of the Deluge, the primitive *place*, or *sea-bed*, became progressively altered and enlarged by the failure of the maritime lands. Consequently, that disruption progressively brought the waters *again* over the surrounding soils; until the *dry land* became a *new bed* to receive them, gathered together a *second* time into *one place*, and abandoning the place in which they had been *at first* gathered together. To this last operation, stands directly opposed that primitive Divine operation by which the Creator, after He had "*rent the depths*[1]"— "*strengthened* or *secured those fountains of the* "*deep*, and gave to the sea His decree, that the "waters should not *pass His commandment*[2]."

The record points out *the period*, when the *waters*, having diffused themselves a *second time* over the globular surface, began to forsake their *ancient bed*; from which bed they continued to descend, until they left it ξηρα, a *dry land*, as the

[1] Proverbs, iii. 20. See *Introd.* § 25. [2] Ib. viii. 28, 29.

former earth had been rendered ξηρα, a *dry land*, by the retirement of the *waters of the abyss*. That period, was at the expiration of *one hundred and fifty days*, or *five months*, from the commencement of the flood. So long as there remained any of the ancient lands to repel the action of the sea, its superficial agitations and reflux continued; but, when the *last land disappeared*, those effects ceased also. The waters then became "*assuaged*"— εκοπασε το ὑδωρ; and, as their *new bed* deepened more and more, their *transfusion* became more and more complete. At the moment when this latter operation was about to commence, the divine Providence *grounded the ark*, which would otherwise have been carried forward by the general *deflux;* whereas, by being *firmly arrested on the summit of a lofty mountain*, the waters *retired from beneath it*, leaving its inhabitants to possess the surface of the new earth where it was *first exposed and rendered dry*.

But, though the waters then began their descent, yet so gradual was the transfer of their mass, that, although the ark *felt the ground* on the 17th day of the seventh month, the ground itself, or summit on which it rested, did not *become visible* until the 1st day of the tenth month, or *after two months and thirteen days*. Nevertheless, continually diminishing in depth in their *first bed*, and labouring for their final discharge, those waters were acting with enormous power upon the loose sedimentary materials of the surface of their basin, producing vast excavations and accumu-

lations, and spreading their diluvial vestiges over the whole; by which effects, that surface must have been very generally altered from the state in which it had subsisted, during the long period of their stationary occupancy.

Had the former continents sunk *all at once*, the immediate and violent *influx* of the great body of the ocean to fill the *vacuum* thereby created, must have hurried the ark into its enormous vortex, and have caused it to be presently ingulfed; whereas, the record represents the ark, like an ordinary vessel, riding securely on the tumultuary surface of the ocean: "the *ark went upon the face of the waters*;" or, as the Alexandrian Jews render the passage— επεφερετο ἡ κιβωτος επανω του ὑδατος — *was borne*, or *carried itself along upon the water*: so also the Chaldee paraphrast, "*ferebatur arca super faciem* "*aquarum*;" which would not have been the case, had not the operation been conducted by a rule that should leave underanged the established nature of the sea. The *transfer of the waters*, was therefore *gradual and progressive*, like that of the *waters of a lock*, in which a vessel descends imperceptibly from a higher to a lower level; which gradual descent implies, gradual and successive subsidences of the former earth, admitting of proportionately gradual advances of the water. So that, the inhabitant of the ark was insensible of the operation; and when, after the entire loss of land, he found it again at the depth of *fifteen cubits*, it seemed as the inundated heights of the land which he had

left, and which had been only temporarily submerged by the flood. Mineral geologists, who acknowledge that the sea once covered our present continents, dispute whether its retreat was *sudden* or *gradual*. Sudden, and gradual, are relative terms; that which is sudden by one comparison, may be gradual by another. A retreat of the entire ocean, effected in the space of *twelve months*, will be a *sudden* operation, compared with that imperceptible mutation of its bed, proceeding through an unassignable number of *ages*, which has been engendered in the imagination of some visionary geologists; but, it will be *gradual*, compared with that immediate and instantaneous operation, by which the universal abyssal waters were originally reduced within the bed of the *primitive sea*.

Thus, then, we discern *two* principal stages of this vast revolution: 1. That of the gradual subsidence of the primitive land, until the surface of the primitive sea, again diffused over it, was lowered to the level of fifteen cubits above its highest internal eminences. 2. That of the further subsidence of that primitive land, until all the remaining waters were entirely drawn out from their *first bed*, into the *deeper bed* formed by those subsidences. And thus it was, that "*God called for* "*the waters of the* SEA, *and poured them out upon* "*the face of the* EARTH[1]"—προσκαλουμενος το ὑδωρ

[1] Amos, v. 8; ix. 6.

της θαλασσης, και εκχεων αυτο επι προσωπου της γης; an operation, which necessarily implies a change in their locality: and thus, the DRY LAND provided by the counsels of God, in this second revolution, to receive the *new generations* of mankind, was *not the same* on which the *former generations* had subsisted during a course of 1656 years[1]. The *sphere of the earth*, was indeed the same; but, the *part of its surface* now exposed and rendered habitable, was *different* from the former habitable part. And hence it will follow, that we cannot attain to any knowledge of the *primitive surface* of the globe; because, the portion of the sphere which for a time preserved that surface, perished in the revolution of *the Deluge;* and, in the portion of it which we now occupy, the primitive surface was effaced in the first revolution which formed the *first sea-bed*. Thus, we are brought back, by the regular course of the history, to that *fragmentary and sedimentary sea-bed* of which we took leave, for a time, at the conclusion of the seventh chapter of the preceding Part; and in which we shall expect to find abundant monuments of "*wreck and ruin*," without resorting for an explanation of those phenomena to any hypo-

[1] "That the earth was divided into *land* and *water* at a period antecedent to the Deluge, is evident (observes Mr. Greenough) from the "remains of land and sea productions so abundantly diffused throughout "the secondary rocks; but, the *situation* which the land and sea respectively occupied before this event, appears in many respects to have "*differed materially* from that which has since been assigned to them." *Geology*, p. 187.

thesis of "*previous worlds*," or, of a "*prior system of things*."

And now, if we are astonished at the thought, that the *perfect physical work* of God should so speedily and so early have been violated by His own act, and should have been *broken up to form a sea-bed* even on the *third day of Creation*, our astonishment will be effectually checked, when we extend our thoughts to contemplate the far greater and more important violation and transformation which *as speedily succeeded*, in His *perfect moral work*; and, it will rise into admiration when we reflect, that the *former* violation, was only a *provident consequence* of the Divine *foreknowledge of the latter*; by which consequence, an apparently disordered portion of the globe was brought into a state of secret reservation and preparation, to succeed the first undisturbed portion on which a doom of destruction would be drawn down, by the disastrous change that would presently take place in the *perfect moral work*. Thus, an intimate correspondence between the *two events*, (awfully illustrating to human short-sightedness and presumption that principle of Divine proceeding, "*what I do thou knowest not* NOW, *but thou shalt know* HEREAFTER,") will reveal itself to the intelligence, reciprocally confirming each other: it being perfectly consistent with the Divine Providence to have prepared the *means of remedy*, before the evil to be remedied had *actually taken effect*; especially, *since God's foreknowledge of the moral change, was no bar*

to His creation of the being in which that change would take place. And if, pursuing this view, we compare in our thoughts the extreme difference between the condition and circumstances of the *new*, that is, of *this present earth* (*whose primitive soils were extensively disturbed, and committed to the operation of the sea and the impregnation of innumerable marine substances, vegetable and animal, for a millenary and half of ages*); and the condition and circumstances of the *former earth* (*whose soils retained the order of their first, unmixed formations*); we may be able, perhaps, to discern a *secondary cause* of the *infertility of that former earth* which received the *curse* of God, and of the *fertility* so remarkable in all the virgin soils of the *present earth* which received His *blessing*. His *physical* world, is entirely subordinate to the great ends and purposes of His *moral* world. We know, that until man caused the formal denunciation of a *curse upon the earth*, the fertility of his *actual residence* was a *special provision* of God; and that, at the moment when he was ejected from that residence of *exclusive fertility*, he found the earth labouring under a curse of *universal infertility*, which continued until it was terminated by the *transmutation of the deluge*. "*Known unto God* "*are all His works from the creation of the world;*" and therefore, foreseeing the disobedience of the first man, and the depravity of the first race of his descendants, His providence may have prepared His globe in prospect of that foreseen event; and,

He may thus have rendered the *first revolution*, which was to *form* our present continents, instrumental by His new laws to the production of the *fertility* which He was pleased to design for them, when, by a *second revolution*, He should have caused them to replace the former continents, from which, by the same laws, equal fertility was withheld by Him.

This true interpretation of the *threat pronounced by God to Noah*, was perceived by Catcott in his speculations *on the Deluge;* but, it availed him little, since it was presently smothered in a wilderness of ingenious but untenable hypotheses. King[1], and Hollmann[2], severally conjectured the *result of the threat*, namely, *the submersion of a former earth and the evacuation of the primitive sea-bed*, as *physical inductions* from *phenomena;* but, without any reference to the *history*. De Luc, both recognised those *physical results*, and duly connected them with the *terms of the threat;* but, as he subjected the history to the rule of his own opinion, instead of endeavouring to correct and regulate his opinion by the rule of the history, he necessarily deviated from the guidance of the history in many particulars, and was consequently led astray by his conjectures into many contradictions to it.

Thus, he denied the *universality* of the deluge;

[1] *Phil. Trans.* vol. lviii. p. 44.

[2] Rozier, *Obs. sur la Phys.* tom. ii. p. 118.

of which, Mr. Greenough justly remarks, that "a general view of the structure of our globe, if "taken with accuracy, would tend to convince "us of the *universal operation* of the deluge[1]:"— "that, the universal occurrence of mountains and "valleys, and the symmetry which pervades their "several branches and inosculations, are further "proofs, not only that *a deluge* has swept over "every part of the globe, but probably *the same* "*deluge*[2]." To maintain his own hypothesis, De Luc indulged himself in many salvos, evasions, and ingenuities. Thus, he affirmed, that the summits of the higher mountains, and of Ararat itself, were *islands* in the primitive sea, which continued to be fertile during all the period of devastation; in direct contradiction to the declaration of the record, which expressly relates, that the *summits of the highest mountains were fifteen cubits beneath the aqueous surface:* making the history bend, in every particular, to a rule drawn from his own previously formed opinions. Nevertheless, the general discernment and assertion of the great fact of *the Deluge*, was the bright point in his geology. So long as his view was confined to the contemplation and exposition of *that fact*, his mind was collected and concentred[3]; when he quitted it, to put himself in search of *the mode* by which *secondary causes pro-*

[1] *Geology*, p. 153. [2] Ib. p. 155.

[3] *Lettres sur l'Hist. de la Terre.*

duced first formations, it became perplexed and bewildered[1]. So long as he confined himself to the defence of the former strong post, he evinced great skill, conduct, and resolution; but, when he once began to *parley with the enemy*, and suffered them to draw him *out of his fort*, he fell into their hands and became convertible to their uses. They were able to neutralise all his objections to *their chronology*, by objecting to him *his own*; and by shewing him, that if he would not concede to them an *anti-Mosaical chronology* in the article of the *deluge*, he conceded it most liberally in the article of the *creation*, which would equally serve their purpose. Thus much it has been indispensably necessary to expose, as a cautionary distinction, and to insist upon relatively to this well-intentioned but dangerous instructor; lest his success in the *one argument*, should become a snare to draw his readers into his failure in *the other*.

Many naturalists seem to have granted the Mosaical statement of the *Deluge*, as by a sort of *compromise*; that they might be free to controvert, or, at least, to turn and bend to their own fancies, the Mosaical statement of the *Creation*. They appear to have thought, that the concession of the *former*, was a full discharge from the necessity of submitting their judgments to the authority of the *latter*; and, that nothing but theological bigotry and intolerance could impose such a restraint upon

[1] *Lettres Géologiques.*

their speculations. But, we have most clearly seen, that sound *philosophy*, sound *learning*, and sound *criticism*, unite intimately to restrict the naturalist, equally in his speculations on the *Creation* as on the *Deluge;* and, to demand the *assent of his Reason, in both, to the precise statements of the Mosaical Record.*

CHAPTER IV.

BUT, if this was truly the case; if the *earth* which we *now* inhabit is not the *dry land* that was *first* brought out of the waters after their incumbency for only *two days*, but, *another* and a *different one*, brought out of the waters after *their incumbency for* 1656 *years*; which *new land*, during all that long period, had constituted the SEA-BED, formed by the universal process of *disruption* and *depression* which we traced and contemplated in the events of the *third day of creation*; if this was *truly* the case, we shall reasonably look, and it will be our bounden duty diligently and industriously to search, for *evidences testifying to so amazing a fact*. And, in such research; we shall naturally,

First, take a general view around us of *the Earth*, as it lies exposed to our immediate observation and common experience; and we shall inquire; *Whether it bears, universally, any appearance of having been, at any period, subjected for so long an interval of time as more than a millenary and a half of ages, to the presence and perpetual occupancy of the waters of the* SEA; and therefore, *of having been, during all that time, the dwelling of the marine portion of the creation?* And, if it should be found to bear such appearance, we shall then inquire

further; *Whether it offers any evidence, that the removal of those waters was effected no longer ago, than the period assigned by the record for their removal?* We shall reasonably insist upon these testimonies; which must necessarily exist, if the *fact* averred in the record be *really* and *historically true*.

"It is evident, (says an able Journalist jealous "of all comparison of *Scripture* and *Nature*,) that "if the testimony of *science* can ever be of any "value in support of *Scripture history*, the *physical researches* by which it is intended to "confirm the historical statements, should be "*most strictly independent*[1]." Upon this sound principle, we commit this research altogether to the *mineral geology*, and are content to abide by its uninfluenced decision. And, in truth, it thus reports: "It is unnecessary to stop, to *prove that* "*our continents have formed the bed of the sea*; "there is no longer any division of opinion among "naturalists upon this point[2]:"—"they agree "only in this, that *the sea has changed its place*[3];" "that *our continents* were, and had for a long "time been, the *bed of the sea*; so that the fundamental object of geology, is to explain *how* "*the sea, after having been more elevated than our* "*continents, has became sunk below them*[4]?"—"In

[1] *Edinb. Rev.* No. lxxvii. p. 198. [2] DE LUC, *Lett. Géol.* p. 301.

[3] CUVIER, *Disc. Prél.* p. 27.—*Th.* §23.

[4] DE LUC, *Lett. Géol.* p. 223.

"examining the mineral masses of the earth, "every thing concurs to indicate, that *this our* "*habitation* has undergone great *changes* and "great *revolutions*; the *sea-shells* incrusted in the "*masses of mountains*, present irrefutable testi- "mony to our eyes that *the sea anciently subsisted* "*upon our present continents; and that animals* "*inhabited those shells, before the mineral masses, in* "*which they are imbedded, were formed:* it will be "manifest to our eyes, that those masses *could* "*not always have been solid*[1].—Every thing also "concurs to indicate, that the *plains of the earth,* "such as those of Alsace, Holland, Lombardy, "&c. were not deposited by the present rivers, "but *in the bosom, or bed, of a tranquil water;* that "the *actual order of the earth, dates only from the* "*retreat of that water;* that the *date, is* NOT VERY "ANCIENT[2]"—"*and,* that it *cannot be carried* "*back above* 5000 *or* 6000 *years*[3]."

"The lowest and most level lands, when pe- "netrated to a very great depth, exhibit nothing "but horizontal strata consisting of various sub- "stances, almost all of them containing *innu-* "*merable productions of the sea.* Similar strata, "similar productions, compose *the hills, even to a* "*great height.* Sometimes the shells are so "numerous, that they form of themselves the "entire mass of the stratum. They are almost

[1] D'AUBUISSON, tom. i. p. 8. [2] Ib. p. 252.
[3] CUVIER, *Disc. Prél.* p. 134.—*Th.* § 34.

" every where so completely preserved, that even " the smallest of them retain their most delicate " parts, their slenderest processes, and their " finest points. They are found in elevations " *above the level of every part of the ocean*, and in " places to which the sea could not now be con- " veyed by *any existing causes*. They are not " only enveloped in loose sands, but are incrusted " by the hardest stones, which they penetrate in " all directions. Every part of the world, both " the hemispheres, all continents, all islands of " any considerable extent, *exhibit the same pheno-* " *menon*.—They have, therefore, *lived in the sea*, " *and have been deposited by the sea; the sea, there-* " *fore, must have existed in the places where it has* " *left them*.—We are, therefore, easily led to " believe, *not only that the sea has occupied all our* " *plains, but that it must have remained stationary* " *there for a long time*, in order to have been able " to form deposits so extensive, so thick, in part " so solid, and containing *exuviæ* so perfectly " preserved[1]: the *basin of the sea*, has therefore " undergone *one change*, at least, either in extent, " or in situation. Such is the immediate result

[1] Pallas observes: " It is, above all, the *clay-stratum* (*la couche* " *glaiseuse*), which proves by its petrefactions that the sea must have " covered it to a very great depth. It is very probable that the *am-* " *monites* and *belemnites*, with the originals of which we are still unac- " quainted, have remained unknown to us *only because they cannot live* " *except at profound depths*. Their abundance in clay-beds below the " calcareous strata, is an indirect proof of this.—The productions " which are supposed to be peculiar to distant seas are, in general, the

" of the *first* examination, and of the *most superficial* observation[1]."

Thus it is, that the mineral geology reports in answer to our *first questions*, respecting the *fact* of the sea having at some period occupied the present continents, and respecting the *time* of its departure from them; and we find, that, although it has prosecuted the inquiry with considerable industry and caution, and with no little jealousy of the Mosaic record, it is nevertheless constrained, by the evidence of *phenomena alone*, to testify in confirmation of the conclusions which we have deduced from the statements of that record, in these particulars. Upon the indications of those *phenomena*, it founds its general class of *secondary*, or *sedimentary formations*.

We shall, therefore, be anxious to ascend higher, and to inquire, in the next place; *Whether we can find monuments equally evident of that great* PRIMEVAL CONVULSION, *which, according to our induction from the record, must have attended the formation of the* FRAGMENTARY BED *or* BASIN *of the departed sea, now converted into this habitable*

" same in the northern seas; but are produced only in abysses (*dans les* " *abymes*), because their existence seems to demand the *pressure of a vast* " *mass of water*." (*Observ. sur les Montagnes*, &c. p. 33 and *note*.) " As we still remain ignorant (says Cuvier) of the greater part of the " testaceous animals and fishes which live in the extensive deeps of the " ocean, it is impossible to know, with any certainty, whether a species " found in a fossil state may not still exist somewhere alive." (*Theory*, § 24.)

[1] CUVIER, *Disc. Prél.* p. 4, 5. § 4.

earth; in which CONVULSION, *that bed or basin was violently deepened, to receive the congregated waters, by means of a vast disruption and depression of the solid frame-work and superior materials of one portion of the subaqueous globe?* If that bed was *really formed* by a process so extensively *destructive*, and if we *actually occupy that bed*, we must, in all necessity, find abundant monuments of "*wreck and ruin*," the natural consequences of that *violence* and that *destruction*.

In this inquiry, the mineral geology, indeed, anticipates our question, by exclaiming: "Are "not all those *pointed pyramids* which detach "themselves, as it were, from the bodies of the "mountains, and shoot up into the air; all those "*bare needles* which rise like pinnacles from the "Alps, *eloquent witnesses of the destruction of the* "*soils which once encompassed them, and of which* "*they formed a part?*—*All the projecting points* "*of rocks which jut out of mountainous masses, are* "*of a similar character, and prove the destruc-*"*tion of the surrounding soils*[1]."—"However "strong a partisan I am of *crystallisation*, (said "Saussure,) it seems to me impossible to believe, "that *such obelisks were originally so formed by the* "*hand of nature: all the substance which they now* "*want, has been broken off and swept away; for, we* "*can discern nothing around them, but other sum-*"*mits, whose bases are equally rooted in the soil,*

[1] D'AUBUISSON, tom. i. p. 227, 8.

" *and whose sides, equally fractured, indicate im-*
" *mense ruins*[1]."—" The numerous blocks of rock
" which are frequently found in certain soils,
" especially those of *granite*, and which are
" shewn, by every indication, to be lying near
" the places where they were *first broken*; are
" *a manifest effect, and therefore proof, of the de-*
" *pression of the soil.*—The consideration of *insu-*
" *lated mountains*, often offers to the geologist
" many subjects for meditation upon *the revolu-*
" *tions which our globe has undergone, and upon*
" *the very considerable depression of its soils*[2]."—
" Some geologists have thought, that the *interme-*
" *diary* or *transition* (*fragmentary*) class of soils,
" might be suppressed, but I am very far from
" agreeing with them: the idea of Werner, in
" establishing it, was very happy; for, it leaves
" in all their purity, if I may so speak, the *two*
" other classes, of *crystalline* and *sedimentary*
" formations. *It relates to an* EPOCHA, *when the*
" MIXTURE *of those two kinds of formations began*
" *to be produced; and when a* REVOLUTION *took*
" *place in nature, which, from the numerous indi-*
" *cations that we witness, is, perhaps, the* MOST
" VIOLENT *of all those which occurred during the*
" *formation of the mineral shell of the globe*[3]."

Thus far, the independence of the mineral geology concurs to substantiate evidences, also,

[1] *Voyages dans les Alpes*, § 2244. tom. iv. p. 414.

[2] D'AUBUISSON, tom. i. p. 230. [3] Ib. tom. ii. p. 199.

of that *primeval convulsion*, that first "*most violent* "*revolution*," which we have deduced from the record; upon the ground of which *evidences*, that geology founds its general class of *fragmentary* or *transition* formations, *intermediary* between the sedimentary, or secondary, above, and the crystalline siliceous, or primitive, beneath.

But, what agencies are there which, by the *laws of nature*, that is, *of the creation*, have principal power to produce the effect of *ruin in the substance of the earth*?

The most powerful agencies, as we have already seen, are unquestionably, *volcano* and *earthquake*. Let us then consider more particularly, the nature and operation of those two agents.

"*Earthquakes*," says the mineral geology, "are most frequent in the midst, or in the neighbourhood, of *volcanos*; so that there is *an intimate* "*connexion between them, shewing them to be, in all* "*probability, effects of the same cause; namely,* "*subterraneous fiery agents*. The most common "and best attested effects of earthquakes, are "*cracks* or *crevices* wrought in the mineral strata, "when they experience a *great concussion*.— "When the concussions are sufficiently violent "to fracture the vaults beneath, either primordial "or formed by the conjunctions of the lavas, or to "burst the pillars by which they are sustained, "those mountains and soils fall back into the "gulf from which they had arisen. It was thus, "that, in the earthquake at Jamaica, in 1692,

" the highest mountain of the island was swal-
" lowed up, and was replaced by a lake: that,
" in Iceland, a mountain of a considerable height
" was buried in one night by an earthquake, and
" its place occupied by a very deep lake: that,
" upon the 11th of August, 1772, the largest
" volcano of Java, the circuit of whose base was
" upwards of twenty miles, suddenly sunk, after
" a short and violent eruption, carrying down
" with it forty villages, and two thousand in-
" habitants: that, in 1638, the volcano of *the*
" *Peak*, in the Molucca islands, which was visible
" at sea at a distance of thirty miles, and which
" commonly served as a beacon or light-house,
" totally disappeared in the middle of a violent
" eruption; and its place is filled by a lake at
" the present day. We are indebted to M. de
" Humboldt for the knowledge of many facts of
" the same nature: we have seen the *Cargu-*
" *airazo*, in 1698, crumble away, and overwhelm
" the neighbouring districts with its mud. And
" ancient tradition relates, that the volcano of
" the *Altar de los Collanes*, in Peru, the height of
" which, it is said, surpassed that of the Chim-
" boraço, sunk down after eight years of con-
" tinual eruption; and its inclining eminences
" only exhibit, at the present day, traces of its
" destruction. In the soils occupied by *extinct*
" *volcanos*, we still perceive indications of sinkings
" or depressions, particularly lakes, which are
" presumed to be the ancient sites of craters or

" volcanic mountains: such are those of Laach, " near the abbey of the same name, a few leagues " from Andernach; such also is the little lake, " perfectly circular, of Paven in Auvergne. And " besides volcanic soils, we meet with many sorts " of mountains, especially those which are of a " calcareous or gypseous nature, which contain " great caverns and cavities; and it is very na- " tural to think, *that the concussions of earthquakes,* " *when they are violent, may occasion the rupture* " *and downfal of the masses which are above them.*"

But, what is the *immediate cause* which gives action to these powerful agencies? " We have " seen, that the volcanos which are *in activity,* " are situated in *islands,* or on coasts *not far* " *from the sea.* Those which we find in the " *interior countries* of the earth, are *all extinct.* " These observations naturally lead us to con- " clude; *that the vicinity of the* SEA, *is a condition* " *essential to the existence of* VOLCANOS: they " further lead us to think, *that the water of the sea,* " *penetrating into the volcanic cavities, is a cause of* " *eruptions.*—But, how should water penetrate " into volcanic cavities? If it penetrates in *great* " *quantity,* (and it would seem that it cannot be " otherwise of *the sea-water,*) would it not rather " tend to *extinguish* the volcanic fire, than to " *increase its action?* This certainly is a question, " the solution of which is difficult; but, though " it may be much complicated, its solution is not " impracticable. I shall not enter into any details

" upon this subject; but I shall confine myself " to the statement of the *known fact*, that *the* " *presence of water, and in great quantity, is incon-* " *testable in volcanic phenomena.* We know the " astonishing power of this fluid, when *reduced to* " *vapour* or *steam;* but, our steam-engines can " hardly convey to us an idea of *the power which it* " *is capable of acquiring in caverns whose sides are* " *several thousand yards in thickness, and which* " *sustain the mountains of Ætna and Chimboraço:* " *heat may extend its elasticity to a point, of which it* " *is difficult to form any idea.* Nor is water re- " duced to vapour the only elastic fluid which " exercises a power in volcanic *foci*[1]."

And, what evidence do we discover, of the *ancient action* of volcanic power? " In considering " the different volcanic soils, with relation to " their different *epochas*, we distinguish, among " the productions of *extinct volcanos*, some which, " speaking by *geological comparison*, are of a " *recent* epocha; since they are *of a date posterior* " *to the excavation of valleys.* But we discover " others of a much more ancient epocha, since " they are *anterior to the formation of valleys;* " these are lodged upon the *summits*, while the " former rest upon the *low ground*[2].—Those of " the *most ancient epocha*, are almost entirely " composed of *basalt*[3]. This substance was emit-

[1] D'Aubuisson, tom. i. p. 213—5.
[2] Ib. tom. ii. p. 516. [3] Ib. p. 553.

"ted from the earth in the form of streams of "matter in a state of fusion, which ran and "spread themselves upon a soil already existing. "Those flowing masses, sometimes of several "leagues in length, and of more than a league in "breadth, often assumed the form of layers, or "beds, one above the other. The basaltic "matter, in cooling, experienced condensation "or contraction; it separated; and the crevices "being perpendicular to its surface, as must "have been the case, divided it into prisms more "or less regular. The most celebrated assem- "blage of the columnar prisms of basalt, is that "which is seen on the north coast of Ireland, "and which is known by the name of the *Giant's* "*Causeway*.—The volcanic soil which forms the "north of Ireland, constitutes also the soil of the "Hebrides; in one of which islands, that of "*Staffa*, is the celebrated *grotto of Fingal*, the "finest basaltic monument known, according to "M. Faujas[1]."

Powerful, however, as these tremendous agents are, some eminent geologists have undertaken to pronounce them *unequal to the production of effects so vast as those which we are investigating*[2]. But then, they have drawn their conclusion from the limited effects of the *conical volcanos* now operative upon the globe. M. Humboldt, who has

[1] D'AUBUISSON, tom. ii. p. 570, 1.

[2] CUVIER, § 17. D'AUBUISSON, tom. i. p. 254—267.

accurately observed the volcanos of what is called the *New World*, remarks: "that the domain of "volcanic action has been *too much limited*;" that we ought "no longer to restrict the idea of "volcanic action to the effects produced by the "craters of our burning volcanos[1]"—that "the "action of volcanic fire by an *insulated cone*, "by the *crater* of a modern volcano, differs "essentially from the action of that fire across "the ancient fissured crust of our planet[2]." It is one thing, to calculate the power of *a volcano*, and another thing, to calculate the power of *volcanic action*; to compute the *actual* effects of an *individual volcano*, whose focus is limited to one point, and which from that point has effected perpendicularly a channel of discharge; and to compute the *possible effects of volcanic power*, rendered *general* within the globe, and acting simultaneously against its solid crusts, without any actual vent to determine its issue. No sound inference can be drawn from the *former*, to limit the power of the *latter*; on the contrary, the former, only furnishes a *datum* by which we are enabled to form a judgment of the *multiplied power* of the latter. The former, exhibits a *particular application* of the latter; but the latter, in its *principle*, is the proper subject of our inquiry. We may securely pronounce, that the *power* or *principle of action* which we contemplate in an eruption of

[1] *Superp. of Rocks*, p. 157, 8. [2] Ib. p. 408. See above, vol. i. p. 216.

Ætna or Vesuvius, is *physically capable* of being extended as much beyond the effects which we witness in that eruption, as the principle of action which blasts a rock, or blows up a fortress, is extended beyond the action which we witness in the spoutings of a *geyser*, or a *Roman candle*. And this is admitted by the writer last quoted, when he observes: "that heat can increase the elastic "force of *vapour* or *steam* to a point, of which it "is *difficult* (he would better have said, *impossible*) "to form an idea[1]." We cannot therefore, philosophically, limit the general question of volcanic action to the measure of the action exercised in the particular case proposed. And, of the insufficiency of the rule, we have *experimental* evidence; because, we are utterly unable to form an

[1] "When I reflected upon the almost infinite power that is some-"times displayed in the eruptions of Mount Vesuvius, throwing up "incalculable masses of matter into the very clouds; I was induced "(says the skilful Mr. Perkins) to consider, how this immense power "could be generated. How is it, that this power is so wonderfully great? "Is it not *high elastic steam*? The thought struck me, that it must be "owing to the *water being confined by pressure*, until it got sufficiently "charged with heat, to enable it to rend asunder whatever confined it, "thereby driving every thing before it. If we wanted further proof "of the tremendous power of *steam*, we have only to inquire of many "practical iron-founders, what it is that has sometimes caused the liquid "iron to *leave its mould and pass off through the roof of the foundry*, "*in a metallic shower*? The answer would be; that a *small quantity* "*of water* had accidentally found its way *into the bottom* of the mould; "and it might also be added, that a thousand times that quantity "thrown on its *heated surface* would be perfectly harmless." (*An Account of the Concentrating Steam Engine*, 1824, p. 2, 3.) This is the action, which M. Humboldt denominates *dynamical*.

estimate, by the action of any existing volcano, of the amazing primeval operation which discharged the *Giant's Causeway* and the *Island of Staffa*! Those immense fusions of *basalt*, demonstrate a remote period of *volcanic effort* in the interior of the earth, totally different in circumstance from the ordinary phenomena of conical volcanos; and of which we have no experience whatever, except in those *effects*. And, if we superadd to the *indefinite extent of volcanic power*, the ordination and direction of its agency to a particular purpose by its DIVINE AUTHOR; we shall at once perceive, that it was an instrument calculated by its laws to operate to the *fullest* extent of the effects which we have ascribed to it, in the first great convulsive rupture of the globe.

The eminent naturalists who raised this objection, carried their conclusions much too far. Their first object, was to refute those speculators who would ascribe the *formation of mountains* to volcanic action. This they have effectually done, by demonstrating the extent of volcanic power in *mineral formations*. But, they wished to make their argument *doubly sure*, and extended it, beyond the virtue of its premises, to limit the possible extent of that power in *mineral ruin*; in this, however, they have totally failed.

Since, then, the *vicinity of the sea*, appears to be a condition essential to the action of volcano; since the admission of the waters of the sea to the *subterraneous fires*, or *principles of fire*, constituted

in the structure of the globe, gives violent and extensive action to volcanic energy; since the sea, previous to the depression of any part of the globe's surface, was in *equal vicinity* to, nay, in *immediate contact* with, every point of that surface; so that the admission of its waters at one and the same moment beneath a considerable extent of it, was able, by the new laws of volcanic action, to cause at one and the same moment an equally extensive *disruption*, and consequent *depression*, of any portion of it; and, since we witness, in all parts of the present earth, monuments of *disruption* in all the *primordial mountains*, of *depression* and *subsidence* in all the *primordial valleys*, of *displacement* and *disorder* in all the primitive formations, and of *volcanic action* coeval with the *origin of all this ruin;* we may, with the fullest sanction of reason, conclude, *that we behold in our continents the effects and monuments of that great* PRIMEVAL CONVULSION, *which formed the basin or reservoir of the primitive sea;* which *monuments*, have been erroneously supposed to exhibit the "*wreck and ruin of previous worlds*," *of whose fragments our present earth has been economically constructed.*

The fractured and irregular portions of the solid frame-work of the globe, which resisted that convulsion, and which now constitute the *chains of the highest mountains*, remain in the stations where their substance was *first formed*[1], and exhibit

[1] "The great and fundamental problem of *theoretical geology*," says Mr. Conybeare, "is obviously to assign adequate causes for the *change*

unperishing examples of their *first formation;* whilst the distribution and outspreading of the depressed parts, into *plains* and *valleys;* the comminution and trituration of the fractured rocks in every dimension, of stone, pebble, and *sand,* "which last, it is well "known, is only an assemblage of *very minute* "*grains* resulting from the *destruction of ancient* "*rocks,* chiefly of quartz, and sometimes consti- "tuting soils of immense extent, as the *great* "*desert of Barbary*[1]," &c.; and the enormous quantities of *marine organic matter,* which are found below the surfaces of the plains, and in elevations far above the level of the waters of the present sea; exhibit positive proofs, *of* THE SEA *having once, and for a very long time, occupied this*

"*of level* of this ocean, which has permitted these masses, which once "formed the bottom of its channel, *to rise* in hills and mountains above "its waves:" (Introd. p. xv.) "one of the great *causes* operating to "effect this great change of level between the land and waters, WAS *the* "*elevation of the former by mechanical force.*" Ib. p. xvii. xviii. note.) This able writer impairs his statement of the problem, by *theoretically* begging the question, of the *rise of mountains by mechanical force.* The first question to be solved, is not "*how did the mountains rise?*" which predetermines the second question; but, "*how were the differences of level* "*between land and sea produced?* Then follows the second question; "*did the mountains rise, or the ocean sink?*" *Theoretical* geology, could never determine the *point of fact* required by this question; but, authenticated *historical* geology, which alone is able to do so, has determined the *fact* to *two* successive and remote *depressions of the channel of the ocean:* by the *last* of which, the masses that once formed the bottom of that channel have been caused to appear in mountains, hills, and plains, above the present level of its waters; or, to speak correctly, the level of the waters has been caused to appear *below* those masses.

[1] D'AUBUISSON, tom. ii. p. 465.

portion of the globe, until it was rendered the habitation of mankind by the departure of that SEA.

Thus far, then, the *general result* of the researches of the mineral geology, coincides exactly with the declarations of the Mosaical record respecting the primeval history of this earth; and establishes, conformably to that record, TWO *great revolutions of its substance*, subsequent to its first perfect formation: the FIRST, *anterior to the formation of animal or vegetable matter*, the SECOND, *posterior to the formation of both:* the FIRST, producing *a first bed, to receive the waters previously diffused over the entire sphere of the earth;* the SECOND, producing *a second bed, into which the waters were transfused from that first bed:* the FIRST, producing "the great disturbances—*fractures, elevations, subsidences*—which appear more "especially in mountain districts;" the SECOND, producing "the traces of *diluvial action* unquestionably visible over the surface of the whole "earth, and for which the simple force of water "acting in mass was sufficient[1]:" the FIRST, "a "*destroying agency*, effecting a destruction of "the original formations of the earth's surface, "followed by successive deposits formed beneath "the waters of the ocean during the progress of "many ages;" the SECOND, "effecting the *dispersion* of the gravel *débris*, and of the remains

[1] *Relig. Diluviane*, p. 258.

" of terrestrial animals buried beneath them[1]." It establishes the *fact*, of the sea having occupied its former bed during the entire compass of time intervening *between those two revolutions;* and finally, of *that former bed being now* THE EARTH *on which we inhabit.* The *causes* employed in effecting the *first revolution*, those which were in action during the *succeeding interval*, and those which operated in accomplishing the *second revolution*, comprehend all the causes of *general revolution* of which the earth really exhibits any phenomena.

We can thus proceed, with full confidence, by the *guidance of the Record.* We know, and are sure, that no revolution general to the globe, has taken place *since the last of those two;* we know also, that no general revolution can have *preceded* that, which *first* interrupted and altered the primitive continuity of the solid surface of the globe; and we have *no reason whatever* founded upon evidence, physical or moral, for assuming, or supposing, that any *general revolution occurred between the two.* There have, therefore, been TWO *and* ONLY TWO, *general revolutions* in the substance and circumstances of this globe; so that *all effects* discoverable, or *appearances* discernible, which are truly attributable to *general revolution*, must find their physical causes in those *binary revolutions*, or in the period of time *intervening between them;* and

[1] *Geol. of England.* Introd. p. lvi. note.

these are amply competent to supply every requisition of *reason* and *philosophy*, in the inquiry after those causes. By this *historical guidance*, we are able to reduce them to their *true order in time*, and to determine their periods with *perfect security*.

CHAPTER V.

BUT, if the free and independent researches of the *Mineral Geology* have *really* discovered, and disclosed, monumental evidences of these great facts; if it has so powerfully enforced the attestation of those evidences, as thus to demonstrate an exact correspondence of the *physical facts* with the *statements of the Mosaical Geology;* why are not the *two* geologies *one and the same*, at least in this *second* question, viz.: the *revolutions* which this earth has experienced? *In what do they differ?*

They differ in *this:* that whereas the *latter* geology propounds *two* and *only two* general revolutions of the globe, the *former* affirms, "*that the* "*revolutions have been numerous*[1];" and, therefore, in attempting to explain the *phenomena*, it ascribes them to various imaginary causes, entirely different from those to which, according to the testimony of those *two* revolutions, they ought to be ascribed. Thus, the *low levels*, or *plains*, between chains of mountains, it ascribes to "*the hand of time* "*alone—la main seule du tems;*" which, "with the "aid of the *atmospheric elements—à l'aide des élé-* "*ments atmosphériques,*" has gradually and imperceptibly *eroded*, and *wasted away*[2], all the immense

[1] CUVIER, *Disc. Prél.* p. 7.— *Th.* § 5.
[2] D'AUBUISSON, tom. i. p. 231.

mass of matter which once filled the *void* between the level of the mountainous summits, and that of the low surface beneath; leaving the mountains themselves untouched:

> Sed *quæ corpora* decedant in *tempore quoque*,
> Invida præclusit speciem *Natura* videndi[1].
>
> But, *how* or *when* this mighty *waste* took place,
> Invidious *Nature* grants us not to trace.

No reason however is assigned, *why* the mountains, which are composed of the same materials with the substance *eroded* and *wasted*, chanced to be *spared*. So that *time*, and the *atmosphere*, must have been unceasingly and capriciously at work, during a *lapse of ages* to which the remotest date of the Mosaical chronology is, by comparison, only as yesterday[2].

But, upon what authority does it ground this contradiction of the record? Is it upon *some other record* which it can produce, and which it can shew to be deserving of *more credit* than that of Moses? for, the question is entirely a question of *historical fact*. No! it can produce no *historical testimony* whatsoever; it grounds its contradiction, wholly and absolutely, upon the same mode of argument and induction by which, in the first part of this inquiry, it concluded the formation of this earth from an *elementary chaos;* and, with the

[1] LUCRETIUS, i. 321.

[2] "Un *laps de tems* qui dépasse presque, il est vrai, ce que notre imagination *pourrait concevoir à cet égard*." D'AUBUISSON, tom. i. p. 110.

same philosophy and the same logic with which it there contradicted *Newton*, it here contradicts *Moses*.

This *multiplication of revolutions*, is no other than a *multiplication of causes*; a procedure, always suspicious in philosophy, because it always wears, *primâ facie*, a character of *deficiency*, either of *judgment* or of *inquiry*. For, true philosophy *abhors a multiplication of causes*, and always seeks to reduce effects to the *fewest causes* that reason will permit: its "*rule of philosophising*" is, to refer effects of the *same kind* to the *same cause*, "*quantum fieri potest—as much as it is possible*[1]." Whereas, the *mineral geology*, far from making the effort which this precept requires, seeks for a *new cause*, that is, a *new revolution*, upon the occurrence of every *new difficulty*; so that its multipled causes are, in fact, not proofs that the *effects require the causes*, but merely, evidences that *it could not reconcile the effects to its own conceptions, without supposing those causes*. But, since *causes* imply *facts*, the supposition of the former, is a supposition of the latter; so that *supposititious facts*, become the basis of its science; and, when it would assign *dates* to those *facts*, it is manifest, that its whole system must be a compound of *supposititious history*, and *supposititious chronology*. Thus it is, that the mineral geologists of Germany, as we are assured, have gravely determined, upon the pretended au-

[1] See above, vol. i. p. 50.

thority of Werner's principles, that "*four great* "*seas*" have *successively*, and *at distant periods*, covered the whole of this globe[1]:—"nor less, "nor more, but just *four seas*."

Thus also it is, that M. Cuvier affirms: that *the* "*revolutions of the earth have been numerous*;" that "*it has frequently happened, that different parts* "*of our continent have risen from the bosom of the* "*sea, and that they have been again covered by the* "*waters*[2]." And, such is the mode in which the mineral geology reasons in general, on the *revolutionary phenomena* of the earth[3].

In the midst of these aberrations, it is with no small pleasure that I find myself able to oppose to such incautious and unphilosophical speculations, the high authority of *Werner himself*. "I "shall observe (says his able and upright disciple, "M. D'Aubuisson), that Werner was *very cau-*

[1] "Dans les ouvrages de géognosie dernièrement publiés en Alle- "magne, d'après les principes de WERNER, on regarde les diverses "formations minérales comme le produit de *quatres grandes mers suc-* "*cessives*." D'AUBUISSON, tom. i. p. 357.

[2] *Disc. Prél.* p. 8.—§ 5. p. 36. See Note [IV.], *On the numerous Revolutions of M. Cuvier*, at the end of this volume.

[3] Plato tells us, that in the time of Solon, "the Greeks had inherited "the memorial of *only* ONE *Deluge*; which the Egyptian priests treated "with derision, affirming, that there had been *many more before it*:"—ΕΝΑ γης κατακλυσμον μεμνησθε, πολλων εμπροσθεν γεγονοτων. (Tim. p. 21.) The mineral geology will probably think, that it acquires a powerful ally in this assertion of the *Egyptian priesthood*; but, a sounder thinker will recognise, in the *simplicity of the Grecian tradition*, a far weightier and more important testimony, than in the unsupported *plurality of the Egyptian assceveration*.

" *tious* on the question of *deluges* and *revolutions* " *of nature;* he never declared himself in a posi- " tive manner: probably, because he had not es- " tablished a definitive opinion upon those mat- " ters; *but, perhaps also, his respect for the* " SACRED WRITINGS *made him apprehend, that* " *the opinions he might express would be misunder-* " *stood*[1]." Here is an example, deserving of the serious attention and close imitation of the *mineral geology;* but, from which it so determinedly deviates. We receive with peculiar satisfaction from the hands of the disciple, and with equal gratification contribute to record, this faithful testimony of his eminent master's mind. We reverence the *geological teacher,* who held his science under the control of that high paramount authority; and we honour the *disciple,* who has rendered this justice to his memory. And we the more regret, that he did not so direct his general studies, as to enable himself to trace out, and to expose, the direct *correspondence* of the *phenomena* which he contemplated, with that *authority;* and thus, prevent the union of his name with a doctrine of " *four successive seas,*" which so pointedly contra-

[1] " J'observerai, que Werner était très-circonspect lorsqu'il s'agissait " des *cataclysmes* et des *révolutions de la nature;* il ne se prononçait " jamais d'une manière positive, vraisemblablement parcequ'il n'avait " pas encore une opinion définitivement arrêtée sur ces matières; *peut-* " *être aussi, son respect pour les* LIVRES SACRES *lui faisait craindre que les* " *assertions qu'il aurait émises ne fussent mal interprêtées.*" Tom. i. p. 369.

dicts those sacred writings which he respected. But, his attention having been principally and ardently devoted to *mineralogy*, he had not equally provided himself with the other branches of knowledge, which were indispensably requisite for enabling him to establish that important correspondence. He has, however, bequeathed to us *a caution* in this recorded sentiment; which is of virtue sufficient to curb the precipitancy of physical conjecture, in every mind in which intellectual acuteness is not deserted by moral ingenuousness.

By the sure guidance of the Sacred Record, which satisfies every condition that actual observation can demand, we are able to reduce to their *true chronological order* the various effects or phenomena, which the mineral geology arranges confusedly and anachronically, through neglect of the *historical rule;* arbitrarily and fancifully *creating facts and dates*, by gratuitously *multiplying revolutions*. For, let us examine, what general phenomena the mineral formations of the earth present, which may not be philosophically referred to one or other of the *four* obvious divisions of the Mosaical geology, *creative, fragmentary, sedimentary*, and *diluvial;* which are correspondently adumbrated, but obscurely and without any knowledge of causes, in the *primitive, intermediary, secondary*, and *tertiary*, of the Mineral geology; viz. either, 1. to the *first formation* or *creation* of the substance and general frame-work of the globe:

or, 2. to the *first revolution*, which formed the *basin of the primitive sea*: or, 3. to the *long period that succeeded*, during which that sea was stationary in its *primitive basin*: or, 4. and lastly, to the *second and last revolution*, in which the sea was *transfused* into a *new basin*, leaving the "wreck and ruin" of its *former basin* to constitute our *present continents*.

To the *first* of these, are plainly to be referred the *sensible characters* and *diversities* of all *primitive formations*, recognisable in the vast *frame-work* of the globe. To the *second*, are to be referred the universal characters of dislocation and subversion, of downfal and ruin, of fracture and dispersion of those *formations*; of subsidences, in primordial valleys and plains; of primitive volcanic eruption, fusion, and transmutation: all which characters, mark the *first period of change* from the *first perfect condition* of the mineral sphere. To the *third*, are as plainly to be referred, the *triturated* character of all the fractured parts of those formations; the *sedimentary deposits* of their comminuted particles, and the incorporation of the *most ancient* of these into their *fragmentary base*; the accumulation of the questionable matter now constituting *Coal*[1], and occupying generally this particular stage in the series of formations; the many volcanos now *extinct*, whose vestiges are found on the *lower levels* of the earth and in *mediterraneous regions* remote from the sea, and which are

[1] See afterwards, chap. xi.

therefore extinct, because their former activity resulted from a *communication with the waters which have been removed from them*: to this long *interval* are also to be referred, the incredibly numerous assemblages of *marine substances* in compact soils, at levels far above the surface of the present ocean; the *failures of the shattered base*, which have rendered *inclined*, and even *vertical*, so many of the *earliest horizontal depositions*; and, lastly, the subsequent accumulation of the latest and actual *horizontal strata* above those[1]. To the *fourth and last* of these periods are to be referred, with equal evidence, the excavation of *valleys of denudation in secondary* or *sedimentary* soils, leaving the lateral parts undisturbed; the transport and aggeration of marine mineral masses; the moulding of the superior soils on their irregular substrata, displaying the evidence of *watery action* as plainly, as a stuccoed surface displays evidence of the action of an artist's trowel; the exposure, exsiccation, and induration of those masses now constituting the *secondary order* of

[1] "The inclined strata, are (in general) *more ancient* than the horizontal "strata; and as they must necessarily have been *formed* in a horizontal "position, they have been subsequently *shifted* into their inclined or vertical "position, and that too before the (present) horizontal strata were placed "above them. Thus, the sea, previous to the formation of the (present) "horizontal strata, had formed others, which, *by some means*, have been "broken, lifted up, and overturned in a thousand ways." (CUVIER, *Theory*, § 4.) "It appears to me," says M. Humboldt, "that, in general, "those rocks that are most inclined, are found *between primitive mica-slate* "*and the red sandstone*:" (*Sup. of Rocks*, p. 68, 69.) i. e. in the *base* of the secondary series.

mountains, hills, and *rocks;* also, various peculiarities of form and disposition, caused, from *local circumstances,* by the mass of waters in the progress of their retreat; the superficial *detritus,* and *colluvia of the sea-basin* spread over all of these; and finally, the confused mixture of *organic terrestrial fragments,* animal and vegetable, previously constituting a part of the furniture of the *perished earth,* which are every where found in soils into which they were precipitated, *whilst those soils formed the soft and yielding bottom of the retiring sea.*

We thus clearly perceive the *fallacy* under which the composers of the first French *Encyclopédie* reasoned, when they pronounced those *phenomena* to be wholly irrelative to the catastrophe of the *universal deluge.* " It is a *truth,* (said they,) " now recognised by the most enlightened naturalists, that *the sea, in the most remote times,* " *occupied the greater part of the continents which* " *we inhabit;* it is to *its residence,* that is owing " the prodigious quantity of *shells,* of *skeletons of* " *fishes,* and of other bodies, which we find in the " mountains and strata of the earth, in places " often very distant from the bed which the sea " actually occupies. *In vain would any one attri-* " *bute these phenomena to the Universal Deluge;* " we have shewn, under the article ' FOSSILES,' " that that revolution, having been merely *tran-* " *sient,* could not have produced all the effects " which the greater part of naturalists have attri- " buted to it. Whereas, in *supposing the residence*

" *of the sea upon our earth*, nothing will be more " easy than to form to oneself a clear idea of the " formation of the *strata* (i. e. *the secondary strata*) " of the earth; and to conceive, *how so great a num-* " *ber of marine bodies are found in a soil which the sea* " *has abandoned*[1]." Those confident writers were little aware, that they were supposing and urging *the very statement of the record;* and, that what they so authoritatively opposed, was, in fact, not the *record itself* but the *misinterpretation of the record.*

" The attempts, (says an eminent *mineral geo-* " *logist* of the present day,) which have been made " by the *Hebrew geologists* to subject the epochas " to absolute measures of time, and to connect the " chronology of *ancient cosmogonic traditions* with " *actual observations* of nature, *have proved fruit-* " *less*[2]." The time is now gone by, for the *continental physical philosophy* to pretend to hold this tone towards the *Records of Revelation:* its pretensions " *have been weighed in the balance, and have* " *been found wanting*." If the ingenuousness of this celebrated naturalist bears any equal proportion to the enterprise of his mind and the extent of his researches, (and I am desirous to believe that it does,) he must now be intimately convinced; that the *insufficiency* he thus insinuates of the geology which he calls *Hebrew*, and which I have called *Mosaical*, is only the expressure of his own *entire*

[1] Tom. x. *art.* MER, p. 359. *Ed. fol.* 1765.

[2] HUMBOLDT, *Sup. of Rocks*, p. 23.

inscience of the power and extent of that geology; and of his *total unconsciousness* of the evidence which he has himself contributed in proof of its veracity, in the very points in which he disparages its authority. Where he "*distin-* "*guished chiefly*, in the assemblage of *monuments* "of different epochas, *three* very striking pheno- "mena—1. the first dawn of *organic life* on the "globe: 2. the appearance of the *fragmentary* "*rocks:* 3. the catastrophe which has *buried* the "ancient monocotyledon vegetation[1]:" he must now become sensible, that the *inverted order* in which he thus presents those great events, through defect of the *historical rule* to guide him, is perfectly rectified and restored by the geology which he has deemed altogether insufficient; and, that "the *first dawn of organic life*," which he has been led by a fallacious conclusion to place *before* "the epocha of the *fragmentary rocks*," in point of fact intervened *between* that epocha and "the "*catastrophe* which *buried the ancient monocotyledon* "(and all other inhumated) *vegetation*." Because "*some* remains of organised beings—appear in "the *mass* of *transition or intermediary rocks which* "*does not exhibit a very crystalline appearance*[2]," (that is, at the *point of contact* where the *fragmentary* and *most ancient secondary* have become compacted in intimate and intricate union,) he most uncircumspectly concludes, "that the *frag-*

[1] HUMBOLDT, *Sup. of Rocks*, p. 382. [2] Ib. p. 129.

" *mentary formation* must necessarily have been " *posterior* to the development of organic life on " the globe[1]." But, when we know, that the fragmentary rocks formed the rugged *basin of a primitive sea*, in which the sedimentary formations successively deposited themselves; and, that the surface of that basin, though now *consolidated* by desiccation, must at that period have been generally *loose and moveable;* we at once perceive, that the *deepest* organic remains now found in that ancient basin, testify, not " *the first dawn of* " *organic life on the globe,*" but only, the *organised beings which have been lodged in its lowest depths*, and therefore, cannot tend in any manner to shew, that the *organised contents* existed before the fragmentary formation of the *basin in which they are contained.* The just and philosophical inference of Pallas from this phenomenon, has been already stated[2]. Those *organised contents of the basin*, being indicative of an epocha preceding their own, namely, *that in which the containing basin itself was formed*, cannot therefore be rationally placed at the head of the series of monuments denoting epochas. The *fragmentary monuments*, so generally devoid of organic remains, must necessarily stand as the leading monument of the series; to which, all monuments of *organic life* must be subordinate, both in *place* and *time*. The " *catastrophe,*" which constitutes M. Hum-

[1] HUMBOLDT'S *Sup. of Rocks*, p. 30. [2] See above, p. 47, note 1.

boldt's *third* epocha, will equally vindicate its own historical position in the series; for, the "monocotyledon vegetation, *buried* by that cata-"strophe" in the same basin of the former sea, will, *like all other buried remains of organised bodies*, testify the *departure of that sea;* by which *departure* only, they have been brought within the reach of our scrutiny. M. Humboldt has entirely excluded from his contemplation, *this last important event;* which *laid dry* the soils in which the organic fragments are *now found buried*, and by which "*the seas that covered the Cordilleras*," (and all other mountains of the globe,) "*were* "*made to disappear*[1]." But, if he will ingenuously examine, and scrupulously trace the relations between all these events, he can have no difficulty in perceiving; that, if "the attempts of Hebrew "geologists to connect the chronology of the "Mosaical cosmogonic tradition with actual ob-"servations of nature, have *hitherto proved fruit-*"*less*," the failure was not owing to any deficiency in the "*Hebrew geology*," but, to the *imperfect state of mineralogical science* amongst those "He-"brew geologists," who inadequately attempted to establish the connexion[2].

The *mineral geology*, though it is obliged to recognise the *four* great characteristical distinctions in the *order* or *series* of formations consti-

[1] *Sup. of Rocks*, p. 6.

[2] See Note [III.], *On M. Humboldt's Theory of Rocks.*

tuting the actual structure of the crust of our earth, is utterly unable to assign any certain *reason* or *cause* for their *existence* or *diversity*, or, any relation of *time* for their origins; whereas, the *Mosaical geology* is able, distinctly and convincingly, to assign both a *cause* and a *reason* for their *existence* and their *diversity;* and is further able, to shew the relation of *time* which pertains to the origin of each. It, moreover, guides us to a sufficient apprehension of the causes, which produced the occasional appearances of *gradual coalescence* between the terms and limits of those formations. The *igneous* or *volcanic* action proceeding from within the siliceous formations, which, in the first revolution, effected the disruption of their superior parts and rendered them *fragmentary;* was capable, also, of acting with enormous chemical power, on the comminuted particles of those fractured masses. That *igneous action*, operated within the basin, and beneath the collective mass, of the *abyssal ocean;* and thus, two vast hostile agents, the extent of whose energies is absolutely incalculable, operated in a conflict of equipollent power, producing the most amazing results, chemical and mechanical, of *fracture, projection, pulverisation, fusion, solution, calcination, transmutation, contortion;* the modes and issues of which bid defiance to the utmost stretch of the research of physical science, and which no processes of our puny laboratories, no agents that we can pretend to direct, can ever aspire to imitate. That those

two great antagonist powers were in universal action on our present lands in the *first revolution* of our globe, follows regularly from the history we have investigated. To *know* that they *must have acted*, is at the same time to *know*, so far as we can receive the knowledge, the *causes* of all the mysterious effects which awaken our amazement in surveying the various mineral phenomena; whether they occur in the Cordilleras of the Andes, or in the N.W. Islands of Scotland. We are *sure*, that we have here a *compound cause* perfectly adequate to all the effects that igneous and aqueous action, acting separately, in harmony, or in hostility[1], can have produced; although we are utterly unable to trace the particular methods of their operation. And, since the same incomprehensible power was called forth at a *subsequent period;* when the same stupendous operations were to be *repeated*, and when the fragmentary and sedimentary formations were to be permanently exposed to the influences of the *atmosphere*, by the discharge and transfusion of the ocean which had lain incumbent on them from the time of their *first formation;* we can further and sufficiently apprehend, that the same modes of operation may have acted in various ways,

1 "*Water* and *fire* acting separately, by what is called the *moist way* "and the *dry way*, have wrought, and are yet working, memorable "effects on the superficial crust or external covering of our earth. *Jointly* "or *in connexion*, their operation is tremendous." MITCHILL, *Observ. on the Geol. of N. America*, subjoined to M. Cuvier's *Theory*, p. 409. New York, 1818.

in various instances, to obliterate by *coalescence*[1] the original line of distinct division between disparous formations: which *blending terms*, being ascribed to false and inventive causes, were calculated to afford ground for hypotheses the most chimerical, on the *mode* of the formation of the diversified series.

With the secure authority of the *historical rule* thus to guide our *reason* in investigating the various phenomena of the earth, one would have thought, that *sufficient causes* were assigned, and in rich abundance, to account *generally* for every phenomenon that can engage the attention of *geology*: for, the mineral geology itself does not pretend to account for *each particular effect*; but is constrained to refer many of them to "*causes which are unknown*," or, to "*causes which have ceased to act*." Yet, those assigned causes are not sufficient to satisfy the mineral geology; even when it is led, by actual observation, to infer the very same *four periods* in the history of the earth. For, thus it likewise states: "The *epocha*, in which we perceive that so great a quantity of *breccia*, *sandstone*, *coal*, &c. were produced, differs so entirely from that which *preceded* it, and from that which *followed* it, that one would be tempted to discern in it a *real change*, rather than a mere *oscillation*, in the course of nature. *It proves to us, a time of* DESTRUCTION; *it indicates*

[1] See above, vol. i. p. 98, 99.

" *a* VIOLENT *and almost* SUDDEN ACTION, *between* " *the tranquil formation of primitive rocks, and the* " *formation, generally tranquil, of calcareous soils*[1]."
We here perceive a remarkable *approximation*, by the acuteness and fidelity of observation alone, to the *true order of events* as they are reported in the record. The able observer perceives, 1. a *primitive* period, in which *primitive rocks* were tranquilly *formed;* 2. a period of violent and sudden *destruction;* 3. a *long interval*, in which the *calcareous formations* were more or less tranquilly *deposited in the sea;* and, 4. he has elsewhere noted the *retreat of that sea*[2]. Here, then, are *all the true periods*, which the Mosaical record enables us to arrange in their proper order, and to assign to their proper dates. But, through neglect of that secure guide, *imagination* interferes; and, the periods thus correctly stated, are afterwards *multiplied* by the *insertion of conjectural revolutions*, in order to account for *the variety of effects* which those *four periods, in fact, alone produced.*

Let us, therefore, proceed to examine, with some attention, the *reasons* which have prompted those *conjectural insertions;* and to investigate, in their detail, the *principal phenomena*, which have seduced the *mineral geology* to require *more revolutions* than it can be supplied with from the *Mosaical.*

[1] D'AUBUISSON, tom. i. p. 361.

[2] See above, p. 46.

CHAPTER VI.

THE first great difficulty which the mineral geology has created for itself, occurs in that amazing phenomenon, the *mingled remains of animals of different species and climates, discovered, in exhaustless quantities, in the interior of all parts of the earth;* so that, the *exuviæ* of animal genera now existing only *within the torrid zone,* and those of genera which *no longer exist at all,* are found confusedly mixed together in the soils of the *most northerly latitudes.* "In examining the mineral masses "of the earth, (says the mineral geology,) "the observer is astonished at the prodigious "quantity of the fragments of *animals* and *vege-* "*tables* which they contain. He will recol- "lect the *order,* in which organic beings are "distributed *upon the surface of the globe;* some, "can only live in the bosom of the *sea,* others, in "*fresh-water;* some, are only to be found within "the *torrid zone;* while there are others, which "would perish the moment they should be re- "moved from the *frigid zone;* in a word, each "species appears as it were fixed to an ele- "ment, or climate, proper and peculiar to it. "Whereas, *in the strata of the earth every thing is* "*out of its place;* the remains of animals which "can exist only in the *depths of the ocean,* are

" found kneaded into rocks which form the *sum-*
" *mits of mountains;* the bones of those which
" can live only in the *torrid zone,* are buried in the
" frozen soil of the *polar regions.* Almost every
" where, he will find *relics of animals and vege-*
" *tables different from those which now exist.* Every
" thing will indicate to him, *that the place of his*
" *habitation has undergone* GREAT CHANGES *and*
" GREAT REVOLUTIONS[1]."

The *Mineral Geology,* contemplating these *various* and *discordant relics,* and reflecting upon the *places* in which they are found, immediately demands *a revolution* different and distinct from either of those intimated by Moses; in order, to account for the *presence of the relics in the places where they now lie.* But, *why* does it need that *other revolution?* solely, because it reasons thus upon the evidence before it: — these *exuviæ* of equatorial animals *are found* in northern latitudes; *therefore,* their ancient owners *must have died* in those latitudes; *therefore,* they *must have lived in those latitudes*[2]*:* and yet, they *could not have lived* in those latitudes, unless a *revolution* has taken place either in the *natures of the animals* or in the *climates of the earth:* but, *no such revolution* is shewn in the *Mosaical record,* or can accord with its recital; *therefore, some revolution in one or other*

[1] D'AUBUISSON, tom. i. p. 8.

[2] CUVIER, *Ossemens Fossiles,* tom. iv. p. 305. *Geol. Disc.* JAMESON, p. 258. Ed. N. York. D'AUBUISSON, tom. ii. p. 513.

of these must be assumed, in order to fill up the chasm in the Mosaical narrative.

Thus it reasons; in manifest perversion of all logic, and in exclusion of the true and obvious explication of the phenomenon. For, unless there is no such thing in nature as *change of place*, and, unless the *exuviæ* of the game eaten in *London* prove that the grouse and hares *died there*, and therefore that they *must have lived there;* the *mere presence of the fossil exuviæ* is no evidence whatever that the animals owning them *died where they are found*, consequently, it is no evidence whatever that they *lived where they are found;* and, if that is the case, all the rest of the argument, which was devised only to *account for their living there*, vanishes at once into air.

The first simple idea which the phenomenon in question raises in a plain understanding, untinctured with system or hypothesis, is an idea of *disorder and confusion*, not one of *order;* and it would therefore *first* inquire, how came all those varieties and disparities of animals to be *jumbled together* there? not, how came they all to *live and die* there? For, their being jumbled together there, is an *unquestionable* fact; but, their living and dying there, is a very *questionable* one. And, since we know that an *entire earth perished*, and that its *whole furniture of animal and vegetable life, of all climates, perished also in the sea which absorbed that earth;* it is certainly much more *reasonable* to assume, in the first instance, that the vast

accumulations of animal and vegetable fragments which are found mingled together indiscriminately in all parts of the *present earth*, were *part of the ancient furniture of animal and vegetable life pertaining to the earth which was destroyed.* For, we know, that such animals once *existed;* that they were indiscriminately *destroyed;* that they were *absorbed* indiscriminately into the mass of waters which effected their destruction; and, that their bodies were *removeable* by its action. If, then, it was *physically possible*, that they should have been *actually removed* by those waters from the surface of the *former earth* into the bed of the *former sea*, and, if *that bed* is now become *our habitable earth*, it was highly probable that we should *discover* such remnants of them as have not entirely mouldered away; and it will then be much more *philosophical* to resort to that *possible cause*, than to violate, by our gratuitous *conjectures*, the *laws* established either for the *natures of animals* or for the *climates of the globe.* Now we shall find, that the *second revolution* of the Mosaic record comprehends *such a cause*, adequate to every effect that we witness, and therefore, the *proper cause* to which we ought to ascribe the phenomenon; and it will then be *unphilosophical*, and *irrational*, to seek for any *other cause* in order to explain it[1].

[1] A sense of the insecurity of concluding at once from *actual* to *primitive* locality, may be acquired by duly reflecting on the following narrative:—"We now entered the dreary region which divides the district of "Cooch Bahar, the present frontier of Bengal, from the country of

"*But*," (observes a respectable writer,) "*in "this hypothesis, the ancient continents must have "existed in those tracts now covered by the Atlantic "and Pacific oceans; if so, I do not* SEE *how ele- "phants* COULD *have been brought into Siberia, or "a rhinoceros be found in it. For, Siberia being*

"Bootan, and which, from its inaptitude to supply the wants, or facilitate "the functions, of human life, may be considered as appertaining pro- "perly to neither. Its extent is little less than twenty-five miles. Near "a small village which we passed in our route to-day, I saw some clus- "ters of *wild pine-apples*. That they *grew wild*, the condition and situa- "tion in which they were found left me no room to doubt."—Were these pine-apples, then, *indigenous* in the frontier desert of Bootan? or, if not, how came they to be fructifying in this dreary and scarcely inhabited tract of *Upper India*?—"To *account for their appearance* in an obscure "village on the borders of Cooch Bahar, *we must have recourse to an "event* which took place in the reign of the Emperor Aurengzebe.—It is "a well known fact, that the pine-apple is not among the indigenous "fruits of India.—The first plants of this fruit that grew in Hindostan, "were brought into India in the reign of the Emperor Akbar, by the "priests of the Portuguese mission. When, in the reign of Aurengzebe, "the general Köuzzum Khan commanded an army employed in the re- "duction of these districts which had not submitted to the Mogul do- "minion, he was detained a considerable time, in the prosecution of his "designs, in this neighbourhood; *during which, among other choice "fruits which he received from the far greater distance of Cabool, and "Cashmere, pine-apples made a part of his supply*."—TURNER'S *Embassy to Tibet*, p. 13, 14. From the *exuviæ*, or *crowns*, of those pine-apples, accidentally thrown aside on the ground of this desolate region, have sprung up the *wild pine-apples of Cooch Bahar*. Without the preservation of this singular *historical testimony*, the *same* quality of ground would have *appeared* for inferring the *indigenous growth of pine-apples* in the north of Asia, as that from which the mineral geology concludes the *indigenous existence of elephants, hyænas, &c.*, in the north of Europe. But, evidence and reason will be found to conspire, in both cases, to subvert that ground altogether; by "*accounting for*" the phenomenon, and by shewing, that *both articles* owe their *actual localities* to adequate, though very different, *powers of transport*.

" *then the bottom of some ocean, the sea must have* " *moved* FROM IT, *to cover the sinking continents,* " *instead of moving* TOWARDS IT, *to strew over it* " *their spoils*[1]."—" *There seems* NO REASON," (observes another respectable writer,) " *why the* " *current should have taken a* NORTHERN *rather* " *than a* SOUTHERN *direction*[2]."

These are, indeed, intelligible and tangible objections, and which place the question upon a distinct *philosophical ground;* they, therefore, claim a full and minute consideration. The question then is; *by what known law could the sea, in moving from its bed, carry backward, and deposit within its bed, the spoils that it absorbed from the continents which it had moved forward to submerge?* and, if there exists any such known law; *why should the current have taken a northern direction?* I have here endeavoured to put the question as pointedly, and as forcibly, as I am able.

This question, though not of *difficult solution* in itself, will not be of *easy apprehension,* unless we will *expand our thoughts* to the full measure and magnitude of the subject; and, unless we will diligently combine within them the *agents now acting generally on the surface of the globe.* But, if we will only do this, we shall find the solution both simple, and obvious to our apprehension; for, *the actions to be explained, are the necessary consequences of the fact admitted in the objection.*

[1] KIRWAN's *Geol. Essays,* p. 62. [2] GREENOUGH's *Geol.* p. 153.

We have perceived, by rational induction, that in this vast revolution the *transfer* of the mass of waters could not have been *immediate* or *simultaneous;* but, that it must have been conducted with much *gradation and calculable succession*, proceeding through *several months*, and proportionate to *gradual and successive subsidences* of the primitive earth[1]. That *graduality*, left the aqueous surface subject to the ordinary operations of *winds* and *currents*. The *limits*, or *coasts*, which circumscribed the sea, gradually *receded* in those subsidences; but, its violence, continually discharged against *succeeding limits*, was followed by the same common effect of *reaction* and *recession of its waters*, which universally attends it. Though the first "*bars and gates*" which resisted its fury were thrown back, yet they were succeeded by others, against which, for a time, it "*raged and* "*swelled*" in vain, and which prescribed its bound until another subsidence permitted it another measured progress; which process continued, until at length the whole became submerged. But, whatever was the *actual barrier* against which its waves at any time broke, those waves, after breaking against that barrier, *receded*, and yielded their place to the waves which immediately followed, in unintermitting succession; and they thus formed *retiring currents, retrograding as the flux advanced.*

[1] See above, p. 31—36.

This natural and necessary operation will be best illustrated, by considering the manner in which the sea *actually operates* upon a coast against which it is continually discharging its waves. "Whilst we see the general phenomena "of the flow and ebb of the sea modified by par- "ticular circumstances, we also recognise, (says "De la Lande,) an *important and general effect of* "*the same phenomena;* namely, the common mo- "tion of the sea from east to west, which forms "a very sensible *current* (the *Equatorial current*) "between Africa and America. It is affirmed, "that there is always an *higher elevation* of the "waters upon the *eastern* coast of America, than "upon the *western* coast. Both of these are a "consequence of the tides; for, the *aqueous* "*spheroid*, carried towards *the west* by the diurnal "motion of the earth, is stopped by, and accu- "mulated against, the *eastern* coast of America; "from whence it can only *return* partially, and "very slowly, by an opposite current, which "probably takes place in the bottom of the sea; "*whilst the water of the* SURFACE *returns to wash* "*the western coasts of Africa and Europe by the* "*natural weight of the waters, which recoil after* "*having struck the coasts of America.* It is the "same in the South Sea; its waters, stopped by "the continent of Asia, *fall back naturally to the* "*coasts of Chili, Peru, and Mexico*[1]."

[1] *Flux et Reflux de la Mer*, tom. iv. p. 305.

Without inquiring here, whether that great *equatorial current* is caused by the *diurnal motion of the earth*, according to De la Lande, or by the *trade winds*, according to the more satisfactory explanation of La Place; or, whether an *inferior current* exists in the bottom of the ocean; the fact is undeniable, *that the superficial mass of the sea, at the equator, constantly moves towards the eastern coasts of Asia, and of America; and, that it returns to the western coasts of America, in the first case, and to those of Europe and of Africa, in the second case.*

This, is the great *law of equilibrium;* which governs the motion of the sea, antecedently to the cooperating or counteracting agencies of winds and tides. The great *Atlantic flood*, which *flows to the eastward;* and of which a part is received into the Bay of Biscay, and being stopped by the west coast of France, and confined by the north coast of Spain, escapes to the north-westward, and pursues its course partly into St. George's Channel, and partly along the western side of Ireland, "*continually casting up articles of various* "*kinds, known to have come from the southward* "*and south-east, in Galway Bay*[1];" is no other than the *reflux* of the oceanic waters cast by the *great Equatorial current* on the eastern coasts of America; which current, perpetually propelling its northern branch along the coast of Brasil into

[1] RENNELL'S *Observations on a Current* W. *of Scilly*, p. 67, note.

the gulf of Mexico, and occasioning the *repletion of that gulf*, obliges it to seek a discharge for part of its mass of waters through the straits of Bahama, thus producing *the Gulf-stream*; whilst *the general superficial mass falls back to the eastward, by the common law of equilibrium.*

By this *law*, easily apprehended, it is evident; that, since the waves of the sea which strike an opposing coast are constantly following each other, the preceding waves, which can advance no further, must always effect for themselves *a retreat*, in proportion as the succeeding waves attain the coast. And thus, *a general* REFLUX *is the necessary and inevitable consequence of the sea's progress against a limit disappointing that progress, and repelling the action of its waters.*

Let us then suppose, that the *eastern coast of America* were to yield to the sea by successive subsidences of its land, yet leaving after each subsidence a *new resisting coast* sufficient to repel the waves; the *reflux* must still be the same as if the continent had remained entire, and the *retiring current must equally make its way back to the coasts of Africa and Europe.* Let us further suppose, that, in the progress of those subsidences, *half* the continent of South America were to be gradually submerged; and, that *half* its surface of vegetation, together with the millions of its animal inhabitants, were to be received and floated off by the waters. It is manifest, that a considerable portion of this accumulated ruin would continue

to float, for a considerable time, and be carried, by the back current, *in a direction towards the coasts of Africa and Europe;* and, although at first taken up by *an advancing sea*, would be *transported* to different distances, and there be deposited, by *the same sea retiring*. It is thus manifest; that the waters, which would be the *first* to enter a bed whose mouth was *unobstructed*, would, if an obstruction of temporary duration were opposed, be compelled to *retire into the rear of their mass*, and so be the *last to enter that bed*. "I must "mention," says Pennant, "the adventitious "fruits, such as nuts and other vegetable pro- "ductions, which are brought by the waves to "these shores (of Norway,) those of Feroe, and "the Orkneys, from Jamaica and other neigh- "bouring parts. We must have recourse to *a* "*cause very remote from this place*. Their *vehicle*, "is the *Gulf-stream* from the gulf of Mexico. "The trade-winds force the great body of the "ocean *to the westward* through the Antilles into "that gulf, whence it is *forced backward* along "the shore from the mouth of the Mississipi to "Cape Florida, doubles that Cape in the narrow "sea between it and Cuba, and from Cape Flo- "rida to Cape Cannaveral runs nearly north, at "the distance of from 5 to 7 leagues from shore, "and extends in breadth from 15 to 18 leagues.— "The mast of the Tilbury man of war, burnt at "Jamaica, was by *this vehicle* conveyed to the "western side of Scotland; and, among the

" amazing quantity of *drift-wood*, or *timber*, an-
" nually flung on the coasts of Iceland, are some
" species which grow in Virginia and Carolina[1]."

Captain De Capell Brooke, also, speaking of the same phenomenon on the shores of Norway and Lapland, observes: "These circumstances shew, " that there is a very strong current setting across " the Atlantic from the American to the European " continent; and this is further confirmed by " the circumstance of a bottle having been picked " up near Tromsoë, which had been thrown over-" board from the North-west Expedition[2]." The same reflective traveller further reports, of "the " seeds of the *acacia scandens;* a climber, which " grows in the forests on the banks of the great " rivers in America, and the pods of which are four " or five feet in length. In the autumn they open " gradually, as the seeds within ripen, and these " falling into the rivers beneath are carried by " the stream into the ocean; and, what seems " extraordinary, are afterwards floated across the " immense space of the Atlantic by the strong " currents, till they reach, fresh and undamaged, " the Norway and Lapland coasts[3]." Such is the *ordinary power of the reflux* of the Atlantic sea, eastward from the American shores.

As then the sea, which *moves westward from Africa and Europe*, is compelled, by the *reaction*

[1] *Introduction to the Arctic Zoology*, p. ciii.—cv.
[2] *Travels to the North Cape*, p. 295. [3] Ib. p. 318.

of the American coast, to move eastward again towards the same regions, and so in repeated successions; by which returns it is capable of transporting, and, as we have seen, *does actually transport* floating bodies to the shores of Europe; we easily perceive, *how the sea, receiving an extraordinary impulse which should cause it to move from its northern bed in Siberia to cover continents gradually sinking in the southern ocean, might nevertheless move northward again towards that bed, and strew over it the spoils which those continents had successively delivered over to the action of its waters.*

Let us now follow this operation with some attention, in its application to *the waters of the deluge.*

By the inundation of the primitive earth from the incessant cataracts of rain and the consequent overflow of rivers during *forty days,* its superior surface or moveable soils would have become drenched, supersaturated with moisture, and loosened from their immediate base; and would thus have been rendered capable of being taken up in dissolution by the waters of the sea on the first failure of that base, and have been fitted for precipitation on whatever new surface they might afterwards be deposited. But, with the superficies thus disunited and separated from its base, and by the *failure of that base,* the entire investiture of *vegetation,* all its plants and herbs, all its woods and forests, together with the *whole animal creation,* would have become successively a

prey to the waters, and would have been *carried off and floated away by the* REFLUX. But, they would not have been *immediately submerged* in the places where they were first seized, in consequence of the gradual procedure of the operation; they would have floated for a longer or a shorter time, and would have been driven by *winds* and *currents* in vast accumulated masses, and in various directions. How *far* they could have been transported before they sunk, and how *distantly* they might have sunk from the places of their first capture, are questions which must depend, 1. upon the length of time bodies can float without sinking, which again must greatly depend upon their bulk, and the texture of their substance and integuments; and 2. on the power of winds and currents for wafting and propelling floating bodies. We have seen, that some bodies, impervious to water, have floated from the West Indies to the coasts of Europe; these, we have also seen, were *brought to an eastern land by the very sea which had moved to the westward*; and we have seen, that it was the *return of that great western flood* that, in *seeking its equilibrium*, brought them to our shores.

Let us then suppose, (what must have been the case,) all the woods and forests of the former earth, of every latitude, uprooted, entangled together, and floating upon the bosom of the ocean; let us further suppose, races of animals of all climates, crowded confusedly in close contact and in numberless masses, implicated in those floating

forests and buoyant upon the face of the waters; and let us suppose all these, while buoyant, to be operated upon by the impulsory power of *retiring currents*, and of *winds* which, during that tempestuous period, must, in *this hemisphere*, have blown with tremendous violence from a *southern quarter*. It is impossible to deny, that such conjoined masses, presenting in their cohesion vast surfaces to those winds and retreating waters, would have been driven to very great distances before all would be submerged. If the continents from which they came were *south of the sea-bed*, and if the sea *flowed to the southward*, they would then be *transported by the reflux in a northerly direction*; just as the waters of the equatorial current, which fall against a *western land*, retrograde to an *eastern sea*. In the *antediluvian sphere*, the space now almost entirely possessed by that great *central current*, must have been in a great part occupied by the former *equatorial continents*. The subsidences of the external borders or advanced lines of those continents, would not have prevented the advancing waters from being *repelled* by the *new lines* successively opposing themselves to its fury; and, *the general movement of the* FLOW *being towards the* EQUATOR[1], *and consequently, the general direction of the* REFLUX *being towards the* POLES, the latter would, in this our hemisphere, have conveyed whatever

[1] See above, vol. i. p. 40, and vol. ii. p. 27.

its surface might sustain in a *northern direction*, so long as there remained any portion of those *equatorial continents* to disappoint and repel the progress of the waters. And thus, a considerable portion of the spoils successively gathered from those continents, would have been transported to, and driven over, the *northern* parts of the primitive sea [1]; would have been sunk upon different parts of its bed; and would eventually have become buried in its soils; whilst the *final flow or ultimate discharge of the sea to the southward*, would have impressed upon the abandoned surface violent traces of its departure, under the simple character of *a current proceeding from the North*. And, if a *great moral end* was capable of being effected by the operation; a *fact*, which the *present argument* renders wholly indisputable; the *transmission and direction of those amazing monuments to their actual stations, by the instrumentality of the natural agent, as future evidences and perpetual memorials of the tremendous nature of the dispensation*, was in every respect consistent with the Intelligence and the

[1] From not taking into consideration the possible action of *a reflux*, Pallas, with many others, ascribes all these effects to *simple progressive action*. But, though he misapprehends the cause, he thus correctly states the effects. "M. de Jussieu has judiciously concluded, with respect to the ferns, and other Indian plants, which are found imprinted "in the states of Europe, that the inundation which immersed them into "those beds, must have *come from the South* or *from the Indian ocean*. "*The same direction, is proved by the remains of terrestrial animals, "which only live between the tropics, heaped together even in the Arctic "soils.*" *Sur la Form. des Montagnes*, p. 44.

Power of Him, who afterwards "*caused a wind* "*to pass over the earth that the waters might be* "*assuaged*[1]."

Upon what ground Mr. Greenough has been led to suppose, that those bodies must have moved over an extent of "*thirty-six thousand miles*, from the "Indian to the Frozen Ocean[2]," I am wholly at a loss to comprehend. For, it is well known, that the entire circumference of the globe is not quite *twenty-five thousand miles;* and, if we suppose the former continents to have existed in the Atlantic, or in the Pacific Ocean, we need only deduct from that circumference the distance from the *equator* to the *pole*, as an extreme average measure; which will be only a *fourth part* of that extent, or about *six thousand two hundred miles*. Over a part only of this last extent they would have moved, in *direct lines northward*, and without finding any lands to obstruct their progress. A vessel which sailed from Halifax, in Nova Scotia, on the morning of the 12th of December, 1821, came to an anchor at Spithead on the morning of Christmas day[3]; having traversed a space of *three thousand miles*, in *thirteen days*. Had it not been for an interruption of *forty-eight hours*, occasioned by foul winds

[1] Gen. viii. 1.

[2] *Geology*, p. 153. "It is scarcely conceivable that these bones "should have travelled from the Indian to the Frozen Ocean, a distance "of 36,000 miles:—*Journal de Physique*, lix. p. 244."—I have been unable to ascertain the cause of this error, there being some typographical defect in the reference to the passage in the *Journal de Physique*.

[3] The NEWCASTLE, 60 guns, Captain FANSHAWE.

encountered in the passage, the course would have been run in *eleven days*. As the wind blew almost a continued hurricane, very little sail was carried. The average of *progress*, was therefore *two hundred and seventy-three miles in the twenty-four hours*. On one day, the vessel actually ran ninety-six leagues, or *two hundred and eighty-eight miles*. Now, the distance from the equator to Tobolsk, in Siberia, is only *four thousand miles;* so that with the same velocity, uninterrupted, a floating mass might have been propelled from the former to the latter parallel in *fifteen days*. The mouth of the river *Lena*, is in the parallel *nine hundred miles* north of Tobolsk; or, *four days* further, with the same velocity of progress.

As we have thus found *a law*, by which an *advancing sea* can float and convey bodies into the *rear of its waters;* and as we can therefore now "*see how elephants could have been brought into* "*Siberia*," and "*why the current should have* "*taken a northern direction;*" let us next consider, the *natural consequence* of such transport to the bodies, when brought, and at length *deposited upon its bottom*.

That bottom, consisting of the loose or fractured materials of the parts which had been depressed to form the bed, and which, during 1656 years, had been subjected to the mechanical and chemical action of the superincumbent sea, was in most parts penetrated by its water; and formed a deep and yielding *paste* of differing qua-

lities, *arenaceous*, *argillaceous*, or *calcareous*. Many bodies would be buried in those *pastes*, by their own weight, or by the weight and ordinary action of the waters rolling over them. Others, would become profoundly immersed, by the peculiar power of the sea in the latter stages of its retreat; when the violent *action of its surface* would have been more strongly communicated to its bottom, in consequence of the increased and increasing *shallowness of its depth:* with diversity of circumstances, arising from various and unassignable *local causes*. To form a judgment of the amazing force of the sea whilst in violent action, and of its tendency and power to bury large bodies in its bottom, we have a very applicable example in the *Bore*, or the extraordinary high tide experienced at the mouth of the Amazon and other rivers of the east coast of America; of which potent agency, Condamine has given the following account from his own experience on the spot.

" Between Macapa and the North Cape, in " the place where the great canal of the Amazon " river is most confined by the islands, the tides " present a singular phenomenon. During the " three days nearest the full and new moons (the " times of the high tides), the sea, instead of em- " ploying nearly *six hours* to rise, attains its " highest elevation in the space of *one or two* " *minutes*. It may be supposed, that this is not " effected very quietly: a terrific noise is heard " at the distance of one or two leagues, which

" announces the *Pororoca* (*Barre* or *Bore*); such " is the name which the Indians of the district " give to this terrible tide. In proportion as it " advances, the noise increases, and presently " one beholds a promontory of water from twelve " to fifteen feet in height; then a second, then a " third, and often a fourth: which follow close " upon each other, and which occupy the whole " breadth of the canal. This surge advances " with a prodigious rapidity, breaking down, and " *shaving clean away*, every thing that opposes it. " I have, in some places, seen an extensive tract " of soil carried away by the *Pororoca*, trees of " very large dimensions uprooted, and devasta- " tions of every description. Wherever it passes, " the coast is laid as smooth as if it had been in- " tentionally and carefully swept[1]."

Of the astonishing power of this aqueous agent to *imbed large bodies*, I hold the following instance from an eye-witness: " At the mouth of a river " in Nova Scotia, a schooner of thirty-two tons, " laden with live-stock, was lying with her side " to the tide at the influx of *the Bore;* which was " then about *ten feet* in perpendicular height. " No sooner had this mass of water reached the " vessel, than that great body was instantly " turned over, like a barrel, and presently " disappeared. After the tide had ebbed, the " schooner was so totally *absorbed into the sand*

1 *Voyage de la Rivière des Amazons*, p. 189, 91.

" *and ouze*, that the *taffel* or upper rail of the deck " was alone visible."

Thus, then, we find in the established order of things, *physical powers* capable, 1. of *transporting the bodies of elephants, rhinoceri*, &c., *from the torrid zone to the north of Europe;* and, 2. of *imbedding them at all the various depths in which they are now found buried, in England or in Siberia:* and this; without requiring any change, either in the *natures of the animals*, or the *climates of the earth*. The *certain knowledge*, that an *entire animal creation* was once overwhelmed and destroyed by *an advancing ocean*, which, by its *reflux*, was able to *transport in a contrary direction* individuals of that creation of every climate, indiscriminately mingled together, accounts, with full satisfaction to the *reason*, for the discovery of the *confused fragments of animals of all climates* in the strata of our earth; and it evinces the incongruity of the assumption, that those animals *must necessarily have died where their exuviæ are found*, and therefore, the further incongruity of speculating, *how they could all have lived there?*

But, M. Cuvier, under the bias of his own ingenious but most fallacious *theory*, denies the fact of the *transport* of those bodies on the following argument; an argument, which does not appear eminent, either for the correctness of its *logic* or for its *consistency*.

" Those bones, (he says,) are almost every " where found in beds nearly similar, namely

" of *moveable* soil, as *sand* or *marl*, and not very " far beneath the surface; we have no authentic " account that they are ever covered by regular " layers of *stone containing sea-shells*, as if the sea " had continued a long time upon them in a settled " and tranquil state. The catastrophe which sunk " them, was therefore a great but *transient* inun- " dation of the sea. The bones, are neither *rolled* " *and triturated*, nor united in *entire skeletons*, but " dispersed, and partly broken; they have, *there-* " *fore, not been brought by an inundation from a* " *distance*, but were found by it on the places " where it covered them, as would have been the " case if the animals to which they pertained had " *inhabited* those places, and had *died* in them. " Before this catastrophe, *therefore, those animals* " *lived in the climates where their bones are now dug* " *up; the northern parts of the globe, therefore,* " *once nourished animals of the species of the ele-* " *phant, hippopotamus*, &c.[1]"

Let us examine these several positions, and the conclusions. 1. " The bones *have not been rolled* " *and triturated*, in the inundation of the sea that " sunk them; therefore, they *have not been trans-* " *ported*." But, if the animals had been transported *on the surface of the water*, and had afterwards been immediately deposited and immersed in a deep bed of sand or of some other soft and conservative sub-

[1] CUVIER, *Ossemens Foss.* tom. iv. p. 303—*Géol. Disc.*—JAMESON, p. 258.—D'AUBUISSON, tom. ii. p. 513.

stance, they would *not have been rolled and triturated*, but would *have been protected against trituration;* this character, therefore, is no proof whatever *against transport*. 2. " They have *not* been collected " together in *entire skeletons*, but are *scattered* and " *broken;* therefore *they have not been transported*." Wherever those animals died, they must have died with their *entire skeletons;* and, if parts only of those skeletons are found, the other parts must have *mouldered away*. M. Cuvier's statement, is much too equivocal and systematic, to yield the conclusion which he wishes to establish by it. In the case of the American *mastodon* exhibited in London a few years ago, most parts of the skeleton were found lying in the same place; but some parts had mouldered and perished. " At " Tonna, in Thuringia, the entire skeleton of an " elephant was found at the depth of *fifty feet*, in " *calcareous tufa*, and in the midst of fossils of " all kinds[1]," whilst in Franconia, and recently in Yorkshire, vast quantities of the fractured bones of elephants, rhinoceri, hyænas, &c. have been discovered lying mixedly and confusedly to-

[1] D'AUBUISSON, tom. ii. p. 505. " A Tonna, en Thuringe, on a " trouvé dans le tuf calcaire, au milieu des fossiles de toute espèce, et à " *une profondeur de cinquante pieds*, un squelette entier d'éléphant.— " Le tuf de la Thuringe repose tantôt sur des galets, tantôt sur des " roches qui constituent les formations de ce pays : il y fait des assises qui " ont, en quelques endroits, plus de cinquante pieds d'épaisseur, et " qui sont composées de strates de tuf compacte et de tuf friable ou " caverneux."—Ibid. p. 472.

gether[1]. The rhinoceros found in the banks of the Vilhoui, and the elephant discovered near the mouth of the Lena, which Cuvier particularly notices, had their entire skeletons[2]; the latter had, moreover, all its flesh and hide, being preserved by the polar ice into which it was incorporated. The mere circumstance, that *only parts of skeletons are usually found*, can prove nothing against the *original transport of entire skeletons:* every churchyard proves this fact by presenting the same phenomenon, of the partial preservation of bones; and yet, we are quite certain, that entire skeletons were originally transported thither, and there deposited. But, let us consider the difference of the two explications, with relation to the *ulterior inferences* which they require. Both suppose a *preternatural action of the sea*, but, in the case of *transport*, nothing need be altered in the established constitution of the globe; whereas, in the other case, we must proceed to speculate further, *how* animals of the *torrid zone* could *have lived* in a *northern latitude;* and we must invent an *hypothesis*, and assume a *revolution*, in order to assign a cause. The *simplicity* of the former solution, is therefore *philosophical evidence of its truth.*

But it has happened, that the *circumstances of position* of these animal *exuviæ* are very different; some are separately and deeply buried in *close strata*, whilst others are crowdedly congregated in

[1] BUCKLAND, *Reliquiæ Diluvianæ.* [2] *Theory*, § 6.

cavities of rocks. The mineral geology must therefore have *different revolutions*, to account for this *diversity of position*; not reflecting, that a *difference of local circumstance or position, would have been a necessary consequence of one and the same revolution in different localities*. "We must not confound "(says De Luc), the phenomenon of remains of "terrestrial animals *deposited in moveable strata*[1], "with that of bones *found in vast quantities in "caverns*; the latter phenomenon *differs essentially* "from the former[2]." To explain which essential "difference," he poetically propounds; that, in the first case, "the animals, in attempting to save "themselves *by swimming — à la nage* — from "islands which sunk beneath them, were in-"gulfed by the sea, and were immersed in the soils "of its ancient bed, in which we now find them[3]:" whereas, in the latter case, the animals occupied their habitations in perfect security, to a good old age; and "*the caverns were — comme des cimetières* "*— sorts of burying-places, into which the animals,* "*when sick, retired to die;* which, (he says,) "*can alone account* for the prodigious quantity of "bones heaped together and incrusted with *sta-*"*lactites*[4]."

These congregated and mingled masses of

[1] *Lett. Géol.* p. 216. [2] Ib. p. 218. [3] Ib. p. 216.

[4] Ib. p. 219.—We possess no evidence from natural history, of this *exequial instinct* in the brute creation. De Luc asserts it universally, on the ground of the particular example which he alleges, of *amphibious animals*, and especially of *sea-calves* (*veaux marins*); which, when ill (he

fractured, yet untriturated bones of extinct and of existing animal genera in *cavities of rocks*, is the phenomenon which, above all others, has excited the interest, perplexed the sagacity, and stimulated the *invention* of the mineral geology: but, all "*play of mind*" for expounding that great phenomenon, is now concluded. The important and extensive means which have very recently been supplied, of investigating and comparing the *characters and natures of the rocks* in whose *cavities* those innumerable mingled fragments of tropical animals occur, have suddenly thrown open to us an entirely new and unexpected prospect of things; and conduct us, at once, to results of answering importance, confirmative both of the *sufficiency of one revolution* for producing all the diversified phenomena we have here considered, and confirmative also, of the *general argument* maintained in this work, by revealing to us the great and pregnant GEOLOGICAL FACT — *that all those rocks, whether in Hungary, Germany, France, or England, pertain to* ONE *and* THE SAME *class of rock*, viz. LIMESTONE; a class, whose texture and composition bear unequivocal evidence, by the intimate and multitudinous *incorporation into their substances of marine organic remains*, that they were *not indurated* during that primitive period,

affirms), *come upon some of the coasts of Scotland to die.* But, although it should be true, that amphibious animals *come out of the sea to die*, yet, no analogical inference is thence afforded, that hyænas and bears *go into caves to die.*

but that they were at that time *soft and plastic*, constituting perhaps a moderately tenaceous, but certainly a *very loose soil*; and loading, in enormous continuous masses, the primitive bed of the ocean. "*The hills in which these cavities are hollowed* (pro-" claims Cuvier) *resemble each other by their com-*" *position*; THEY ARE ALL OF LIMESTONE—*Les* " *collines où ces cavernes sont creusées se ressemblent* " *par leur composition*; ELLES SONT TOUTES CAL-" CAIRES[1]." I shall, now, endeavour to trace out the indications of this great GEOLOGICAL MONITORY.

" *Limestone*," says D'Aubuisson, " constitutes " the principal mass of *secondary soils*; and may " be considered as *only one enormous calcareous bed* " *forming, with but little interruption, the external* " *coating* (*enveloppe*) *of the solid mass of the globe*[2]." That the matter of that universal mass was *fluid* or *plastic* at the time when it received into its substance the *shells* and other *marine bodies* which are incorporated into it, and which often crowd it to excess so as even sometimes to form a *shelly breccia*, is as undeniable, as that the agent was *fluid* by which a *rocky* or an *osseous breccia* has become conglutinated; and, although we have *now* no experience of limestone in a plastic or loose state, and are acquainted with it only in its quality of solid and indurated rock, yet, those *incorporated evidences* establish the

[1] *Ossemens Fossiles*, tom. iv. p. 303.

[2] *Traité de Géognosie*, tom. ii. p. 335.

ancient fact of its *fluidity* as securely, as if we could now see and handle the substance itself in that state. On which account, the same acute and upright geological inquirer observes; "Let "us conclude, that, *in natural history, there are* "*few facts established upon such strong proofs as* "*the aqueous fluidity of secondary soils, properly so* "*called*[1]." Thus, then, we have to recognise *a period, in which the substance of the enormous limestone bed coating the solid mass of the globe, existed, not in a hard and consolidated state above the waters, but in a soft and yielding state within them.*

But, although we have no experience of *this substance* (*calcareous matter*) in such an incohesive state, and therefore no experience of the process of transition which has now rendered it cohesive and solid, yet we have experience of *another sea-soil* (*arenaceous matter*) actually so diversified, and which is continually and overtly undergoing a *similar indurating process* for our instruction; from which we may form a correct conception, by *analogy*, both of the process which has eventually caused the *induration of the limestone*, and, at the same time, of the fundamental insecurity of any judgment which we might pretend to pronounce,

[1] "Sans nous arrêter sur ces dernières considérations, concluons de ce "qu'on vient de dire, que, dans l'histoire naturelle, *il y a peu de faits* "*établis sur d'aussi fortes preuves que la fluidité aqueuse des terrains* "*secondaires*, proprement dits." D'AUBUISSON, tom. i. p. 383. (*Fluidité des masses minérales.*)—"The *ancient fluidity* or the *softness* of the stony "beds, is proved by the fossil bodies, or the fragments, imbedded in the "transition and secondary rocks—."HUMBOLDT, *Sup. of Rocks*, p. 9 and 67.

from *inspection of the rock alone*, respecting the *date* or *period* of its *first induration*. "I saw (says "Saussure) on the border of the sea near the "light-house of Messina, not far from the gulf of "Charybdis, sands which are still *moveable* at the "moment when the waves accumulate them on "the beach; but which, by means of the calca-"reous juice which the sea infiltrates into them, "gradually harden to such a degree as to serve "for *mill-stones*. This is a fact well known at "Messina: stones of this substance are conti-"nually removed by the inhabitants from the "beach, without exhausting them, or producing "any depression in the level of the shore; the "waves throw up fresh sand into the hollows, "and, *in a few years, this sand unites itself so "closely, that it is no longer possible to distinguish "the stones of new formation from those which are "the most ancient*[1]." This fact, attested by an authority so high and unexceptionable in the mineral geology as that of Saussure, respecting a *sand-stone formed under our eyes*, demonstrates

[1] "J'ai vu au bord de la mer, sur le Phare de Messine, auprès du "gouffre de Carybde, des *sables* qui sont *mobiles* dans le moment où les "flots les amoncèlent sur les bords; mais qui, par le moyen du suc cal-"caire que la mer y infiltre, se durcissent graduellement au point de "servir à des pierres meulières: ce fait est connu à Messine; on ne "cesse de lever des pierres sur les bords, sans qu'elles s'épuisent, ni que "le rivage s'abaisse; les vagues rejettent du sable dans les vides, et, *en "peu d'années, ce sable s'agglutine si bien, qu'on ne peut plus distinguer les "pierres de formation nouvelle avec celles qui sont les plus anciennes.*"—*Voyage dans les Alpes*, § 305.

our absolute incapacity to pronounce, with any nice distinctions, of the various ages and formations of *limestone, the formation of which has never been so witnessed by us*[1]. All that we can securely venture to pronounce, is, that the fluid calcareous matter began to indurate from the time of its *separation from the waters* which *contained it;* but, we must address ourselves to competent *historical testimony*, in order to be able to *find the true date of that separation.*

Now, when we carry our thoughts back to those vast congregated masses of bodies—"*of "animals of all climates, confusedly crowded in close "contact, buoyant upon the face of the waters, trans- "ported in a northerly direction by the reflux cur- "rents of the departing ocean, and finally sunk in "the loose soils of a Northern Sea*"—which we have so lately contemplated in the wreck of the former perishing earth[2]; and, when we now consider, that *similar congeries of bodies have very recently been discovered, incarcerated in the interior of a class of rocks which, at that remote period, constituted the most abundant and extensive of those loose soils, although, since the departure of the waters,*

[1] "Although," says Mr. Konig, "there are many instances of gravel "and sand being *quickly formed into hard masses*, yet we know of *no* "*limestone being formed as it were under the eyes of men.*" Nevertheless, he justly observes; "It may be safely concluded, that a calcareous "rock, containing *bones* and *shells*, must have been in a *soft* or *semi-fluid* "state."—*Phil. Trans.* vol. civ. p. 110, &c.

[2] See above, p. 93—96.

they have become indurated into the solid substance to which we have assigned the name of LIMESTONE; when we duly compare, and reflect upon, these *two great reciprocating facts,* and the extraordinary and direct relations of *correspondence* which they so signally reveal; it would seem to appear manifest to the intelligence, from all that has preceded, and from all that will hereafter be observed, —*that some of those masses of bodies, after having been floated and driven together from the southward to those points of the sea-bed which now are become Germany or England, were there at length simultaneously deposited, and immersed by the turbulent vortices of the diminishing waters in the soft substance of the limestone*[1]*; like the bodies of elephants, and other animals, whose remains are found immersed in beds of clay.* Let us, therefore, endeavour to trace the probable and natural *consequences* of that vast and amazing operation; and let us observe, *to what correspondence with the phenomena of the caves in question they will conduct us.*

The tremendous concussions and collisions which the frameworks of many of such vast aggregated masses of floating bodies must have sus-

[1] "*Jura limestone* (says M. Humboldt) covers without interruption a "great extent of country, from the chain of the Alps as far as the centre "of Germany; from Geneva, as far as Streitberg and *Muggendorf in* "*Franconia.*—In England, the *formation of Jura,* stretching without in- "terruption from *Yorkshire* to Dorsetshire, fills the whole space between "the red marl (variegated sandstone) and the chalk." (*Superp. of Rocks,* p. 359, 364.) These widely extended formations remained *fluid* and *incohesive,* until the discharge of the primitive ocean.

tained, from the force and conflicts of the waves dashing them against each other in their long and tempestuous traverse, and from the force likewise of the oceanic vortices which finally precipitated them downwards on their mineral bed and plunged them promiscuously within it; will be readily apprehended, by contemplating the enormous power exercised by the same terrific agents, in crashing and ingulfing the stoutest frameworks of floating vessels subjected to their fury; and the skeletons, thus variously and violently dislocated and fractured within their integuments, would have been prepared to separate their parts, when the flesh and the integuments should eventually have perished[1].

When the sea *finally departed*, the recipient plastic mass necessarily remained fixed in its actual form and position, together with the foreign substances which it inclosed; and, after a course of exsiccation, by evaporation and filtration, it became at length indurated into *secondary rock*. The *successive cumulations* in the sea-bed, which formed the mass, would have caused it, when exposed, to dry in *distinguishable beds* betokening the succession of the cumulations. For, these would have been cast up and propelled by the throes and struggles of the ocean, increasing in force in proportion to the diminution of its

[1] See note in the *Introduction*, on the effect of a wave at Ramsgate, in 1822.

depth; but yet at different intervals, being interrupted by the tides and reactions of the oceanic body; so that each cumulation would have acquired a tendency to unite its mass, before a succeeding cumulation was superadded to it; and, the *fluidity* of their substance, yielding at once to the laws of gravitation, would have caused them to settle in those regular horizontal planes which have led some theoretical writers to *suppose*, that they must have been gradually deposited or *chemically precipitated* in a tranquil water, in separate particles and through a series of ages, as sediment is precipitated in a phial: a supposition, which the irregular commixture and involution of *marine substances* positively destroys.

The transverse or longitudinal intersections of the calcareous mass, effected by the violent *transcident* currents of the sea which ploughed through it in the furious deflux of its departure, would have *laid open* the order of those successions, by excavating what have on that account been denominated, *valleys of denudation;* evincing, at the same time, the *yielding nature* of the substance which was expelled. The several strata would probably have attained successively, though not remotely, the perfection of rock, according to the greater gravitation of the mass, or its speedier liberation from the fluid; and would thus acquire an equivocal character, calculated to give rise, in future ages, to various plausible but fundamentally erroneous assumptions, respecting *ages* and *formations* of

the rock; and from thence, to a natural but *anachronical* conclusion, " that the bones found " within it, *must* have been lodged in the cavities " which contain them, at periods *long subsequent* " *to the formation and consolidation* of the strata " in which those cavities occur." Whereas, no sufficient reason can be shewn, or exists, why they should not have entered the limestone during its *primitive state of fluidity;* at the same great epocha with the *shells, corals, echini,* &c., which certainly *did enter it,* and which it now equally, and visibly, embraces.

The process of *exsiccation* producing the *contraction* of the matter of the mass, by the mutual attraction of its homogeneous particles freed from the intrusive fluid, would have caused it to recede from, and to leave it the foreign matter enclosed within it more or less detached from its own substance in a *nidus* or *cavity;* the *dimensions* of which *cavity* would necessarily have depended, first, on the *quantity and bulk* of the foreign matter itself; but finally, on the degree of *resistance* which its *solidity,* or the propulsive force of the *vapour* arising from its putrid fermentation, had been able to *oppose to,* or, of *compression* which it had ultimately *sustained from,* the gravitating weight, contractile concentration, and progressive induration, of the enclosing and settling mass: in the *former* of which cases, the dimensions of the cavity might still remain considerable, relatively to the animal mass within; but, in the *latter* case, it is probable that

the brittle and frangible parts of those animal substances, that is to say, the *bones*, which had already sustained dislocation and fracture from the waves and billows that transported them, would have become still more forcibly and variously crushed and splintered, and *the whole have been compressed into a much narrower space than they had at first possessed.*

In many of such *cavities*, it is highly probable, that a portion of the fluid which the drying and hardening rock discharged by filtration, would eventually, in its percolation through the calcareous substance of the limestone, have formed a coating of stalactite suspended from the upper surface of the cavity; whilst a more copious portion, perpetually dropping to the bottom, would for a long time have continued to maintain the *liquidity* of the loam or mud which had entered with the bodies from the *sea-bed*, until, by the gradual diminution of its quantity, it at length established a solid flooring of *stalagmite:* which latter substance, would naturally have formed its incrustations according to the *direction of the fluid*, and according to the *consistency of the loamy sediment*. If the calcareous fluid, draining down the sides, flowed to *the bottom of the cavity*, it would, where the mud was *liquid*, have insinuated itself beneath it, and have deposited its stalagmitic matter on the *lowest subjacent surface;* if it fell directly from above, the stalagmite would have been formed, either on the *upper surface of the mud*, if firm

enough to resist the fluid, or, in *branches* striving to penetrate through it to the *surface below*. The formation of these incrustations, would probably have been the last operation of the percolating waters. The quantity of fluid with which the mass was originally saturated, and the rapidity of its descent, would not at first have allowed of such depositions; it would have been only when the fluid was near exhausture, and, instead of *flowing*, began only to *distil* from the mass, that it would deposit the calcareous particles which its retarded progress enabled it to carry along with it in solution. Meanwhile, the animal substances occupying the interior of the cave, gradually dissolving into their elements, would have become considerably diminished in quantity of solid matter; and, having never been exposed to *rolling* or *trituration*, but having been *protected against it* from the time of their first immersion, such portions as had not decayed and perished, would necessarily exhibit surfaces wholly *untriturated*. So long as the fluid was abundant, much decay and decomposition would necessarily have taken place; but, when it was able to deposit its *stalagmite*, the incrustation of that substance, and imbedment in the desiccated mud, would have suspended those effects, and have preserved the remainder from perishing. And further, because all the bodies were immersed *simultaneously*, in one vast united mass; although they might have drawn down with them in their vortices much of the mud, or loam,

or pebbles, which were present on the part of the sea-bed where they were ingulfed, yet no *alternations* of animal and mineral matter would have taken place.

The *pebbles*, which would have been thus introduced with the bodies into some of the cavities, would probably have owed their rounded forms to very different causes. Those which consisted of fragments of primitive rocks, would have derived their forms from long previous *trituration* in the sea-bed; but, those which consisted of *limestone*, would not have received their rotundity from *trituration*, the limestone not being yet indurated, but from *conglobation*, like those of *sea-clay*, so commonly found in various degrees of hardness and tenacity upon a sea-shore during the ebbing of the tide.

If the cavity existed far and deep within the indurated limestone mass, it would only be discovered on penetrating far and deep within it; but, if it chanced to lie near the external surface, or *escarpment*, it would probably have been revealed, either by the early crumbling of the drying and feebly sustained soil in that part, or, by the *crevices* and *fissures* which would have been naturally produced in the drying of a *mineral paste*, saturated with water, and suddenly and permanently exposed to the action of *air* and of *heat*. Or, if the bodies accumulated within were in *very considerable numbers*, the fermentation of

so vast a quantity of animal corruption must have generated and developed a *vapor*, of force sufficient to *distend* and *protrude* the soil of the sides whilst they were yet soft and yielding, and even to *expel* the part which opposed to it the least resistance, thus creating for itself a *spiracle* or *vent*; by which various means, *channels* and *orifices* bearing no relation of geometrical proportion to the *original bulk* of the animal bodies contained within, would occasionally have been formed.

This operation, and its general effect upon the bodies, would only be a *vast enlargement* of that which we so commonly witness on a *minute scale*, in limestone rocks containing shells. In those rocks, in consequence of a similar process of exsiccation producing contraction and compression of the mineral mass, we sometimes observe the shell to be broken, sometimes altogether crushed, and sometimes, again, entire, and freely moveable within its little cavity; and we often perceive the sides of that cavity to be coated with small crystals produced by the filtered fluid, as in the large cavities by stalactite. Now, "that which "is so readily imagined on a *small* scale," observes justly Dr. Macculloch, "is as easily transferred "to a *larger*; since, in the operations of nature "*these terms are of no moment*[1]." We obtain, therefore, from what has been here exposed, a

[1] *Geological Description of the West. Islands of Scotland*, vol. ii. p. 102.

strong philosophical probability—*that the accumulated and mingled masses of tropical and other animals whose bony fragments have been found in Hungary, in Germany, and in England, in the interior of one and the same class of* SECONDARY ROCK *containing in its substance, in numberless instances, fragments of shells and other marine organic remains; were there enveloped, after transportation and deposition, by the substance of the rock during its pristine state of fluidity in the bottom of the primitive sea;* just as the *shell* was unquestionably involved by the same substance *during its pristine state of fluidity;* and in no other manner: that the *cavity* in which they are found, was originally moulded upon the general surface of the congregated mass, as the *nidus* of the shell was unquestionably moulded upon its surface: and, that the *orifices* and *channels* in the rock, which communicate with those internal cavities, were produced by one, or other, or all, of the causes which have been described.

The *greater* of these operations, appears to reveal itself unequivocally to our apprehension in *the Cave* recently discovered *in the interior of a* LIMESTONE ROCK at Kirkdale in Yorkshire; in which cave has been found, a mingled accumulation of the bones of some hundred tropical and other animals, *hyænas, elephants, rhinoceri, hippopotami,* &c.; variously broken, crushed, and splintered; compressed within a series of narrow and disproportionate channels; partially imbedded in

a flooring of stalagmite; and exhibiting no character or symptom of trituration: whilst, at the same time, "the stratum of compact limestone, "in which the cave is situated, is full of *corals* "and the *spines of the echinus cidaris*,—and the "sides and roofs of the cave reveal, in the sub- "stance of the rock, half-corroded fragments of "*coral, shells*, and the *spines of echini*," bearing positive and incontrovertible evidence to the *primitive fluidity*, and *subsequent induration*, of the general mass. All which effects appearing to be simply and amply accounted for by the principles and causes here ascertained and exposed, it is with the most irksome repugnance that I find myself compelled to contest strenuously, but with every sentiment of the respect which is so largely due, the adverse explication of those phenomena, propounded by the able and highly distinguished Professor to whose valuable labours we are wholly indebted for the knowledge of them; and whose liberal and important information respecting them has been imparted to the world, since the publication of the first edition of this work[1]. As this subject has awakened a more than ordinary in-

[1] "*Account of an Assemblage of Fossil Teeth and Bones of Elephant, "Rhinoceros, Hippopotamus, Bear, Tiger, and Hyæna, and sixteen other "Animals; discovered in a Cavern at Kirkdale in Yorkshire,*" &c. By the Rev. WILLIAM BUCKLAND, Professor of Mineralogy and Geology in the University of Oxford, &c. &c. *Philosophical Transactions for* 1822, p. 171, &c.

This curious Memoir, augmented by its able author with the results of many enterprising and highly important geological researches both

terest among us, I shall offer, in a *separate form*, such further considerations upon it, as would exceed the plan and compass of the general argument undertaken in this *Comparative Estimate* [1].

The Edinburgh Reviewer of the "*Reliquiæ* "*Diluvianæ*," cries out, on the preceding argument—"how any person who had either seen a "cave, or read Mr. Buckland's book, could form "such an *hypothesis*, as that the contents of the "caves at Kirkdale, and other places, were of "*contemporaneous deposition with the rocks* in which "they occur, and the caverns themselves pro- "duced by gazes evolved during the putrefaction "of the bodies within the substance of the strata, "we are entirely at a loss to conceive!!". This impatient and unphilosophical ejaculation, is the whole of his criticism or reply. So little has this respectable writer cared to apprehend the argument which he thus fastidiously rejects, that he states my position to be, the *contemporaneous deposition of the rocks with that of their contents*. Whereas, my readers will have clearly seen, that I allege the contemporaneous deposition of the bodies, not with the *deposition of the rocks*, but, with the *event* which first brought into a course of *desiccation* and *consolidation* the fluid calcareous mass; which *had been deposited from the time of the*

in England and Germany, and illustrated by twenty-seven valuable and well-executed engravings, constitutes his work, entitled "RELIQUIÆ "DILUVIANÆ, &c., *attesting the action of an Universal Deluge*."

[1] See the *Supplement* to this Chapter.

first formation of the sea-bed. Now, does the learned Reviewer mean to deny, that all the secondary limestone formations of the globe were once *soft and fluid?* or, that carcasses deposited upon them in that state, would *have sunk within them?* or that, when sunk within them, they would *have putrified within them?* or that, in putrifying, they would *have evolved gazes?* or, that those evolved gazes, if they obtained no *vent*, would *have distended* the parts of the calcareous paste in immediate contact with the bodies, and would have produced a *vacuous space around them?* or, that if the water, which gave softness and fluidity to the calcareous mass, was drained from it, it would *have indurated?* or that, when indurated, it would *have retained* the internal effect, of a *cavous* or *cavernous space in which the animal remains would lie?* This connected *chain of possibilities* had not entered into his conception, and he will not expand his thoughts to embrace it; and he therefore holds fast to the impressions which he had received before they were suggested to him: thus, affording us a signal instance of *prejudication.* But, that *all* the secondary limestone formations of this globe were *once fluid*, and, that their present *solidity* is altogether a consequence of their *drainage and desiccation;* is a position which all must admit who will patiently reflect upon it but for a very short time, and who are not afraid to close with the dictation of their reason, merely because the subject is *vast*, and the position *novel:*

the entire elephant *buried in calcareous tufa at a depth of fifty feet*, bears direct testimony to this fact[1]. And, if those formations *were once fluid*, all the chain of consequences here drawn out, must necessarily have followed in the course of *desiccation*. This is not *hypothesis*, but direct inference and induction from a collation of *history* and *physics*.

Thus, then, every thing concurs to testify; that the bodies of *equatorial animals* found in *northern soils*, were transported thither by the great agent which we have ascertained, namely, *the* REFLUXES *of the diluvial ocean, during the year of its gradual departure;* and thus we perceive, that the phenomenon of *their presence in those soils*, is amply accounted for by the *Second Revolution* reported in the Mosaic Record.

[1] See above, p. 103.

CHAPTER VII.

THERE is a *phenomenon*, intimately connected with the preceding, which will demand our most particular consideration.

The Mosaical record asserts; that the catastrophe which caused the universal destruction of the *brute creation*, caused likewise that of the whole *human race*, one family alone excepted. But, if the *human* creation perished at the same time with the *brute*, we naturally expect to find *human exuviæ* no less than *brute exuviæ;* whereas, the mineral geology observes, "in all the extensive moveable soils in which we find the bones of these large quadrupeds, and in which we find also bones perfectly similar to those of our horses, oxen, dogs, &c. *no human bones are ever found*[1]."—"It is certain, (says M. Cuvier,) that human bones have not been found among fossil bones; and yet, the former are *as durable* as those of the brute species, if placed in *similar circumstances*.—Every thing, therefore, leads us to believe; that the human race did not exist in the countries where fossil bones have been discovered, at the epocha of the revolution that buried the bones, although

[1] D'AUBUISSON, tom. ii. p. 514.

" they may have inhabited other countries.—
" The place which man then occupied may have
" been submerged, and his bones buried in the
" bottom of the present seas; all, excepting the
" small number of individuals that continued
" their species.—The establishment of man in
" those countries in which we have stated the
" fossil remains of terrestrial animals to be found,
" that is, in the greater part of *Europe, Asia, and*
" *America*, must *necessarily* have been *posterior*,
" not only to the revolutions which *imbedded* the
" bones, but also, to those which have *exposed*
" the soils enclosing them; which *last revolutions*,
" are *the last* that our globe has sustained.—In
" closely examining all that has passed on the
" surface of the globe since it was laid dry *for*
" *the last time*, when the continents assumed
" their actual forms; at least in those parts which
" are at all elevated; we see clearly, that *this*
" *last revolution, and consequently the establishment*
" *of the actual societies of nations, cannot be very*
" *ancient*. This is one of the results the best
" proved, and the least expected, of *sound geology;*
" a result so much the more valuable, as it con-
" nects, by an uninterrupted chain, *natural his-*
" *tory* and *civil history*[1]."

This is, indeed, a most important remark of the *mineral geology;* but, there is yet a step or two for it to take, before it can become " *sound geo-*

[1] CUVIER, *Disc. Prélim.* p. 64—68.

" *logy.*" We find here, many valuable concessions to the *Mosaical geology;* viz. " that *mankind* " did not inhabit our *present continents,* until *after* " the revolution which imbedded the confused " multitude of bones found within their soils:— " that they may have inhabited *other continents:*— " that their *exuviæ* may be buried in the bottom " of the *present sea:*—that the revolution which " has exposed the soils containing the fossil " bones, is the *last* which our globe has sus- " tained:—and, that this last revolution, and " consequently the establishment of the *actual* " *societies of nations* in Europe, Asia, Africa, and " America, cannot be *very ancient.*"

These are, indeed, remarkable *concessions;* but, we find them associated with the constant error of *multiplying revolutions* without any reason, which must necessarily *falsify both history and chronology.* This distinguished writer assumes, gratuitously, that *the revolution* which *exposed* the soils containing the *fossil exuviæ,* was *different from* and *posterior to* that which *imbedded* them; and different, again, from that which *gave origin to the actual societies of nations;* consequently, that *all the three events* took place in *different revolutions,* and at *different periods of time.* Whereas we must clearly perceive, by the record, that *all* were effects of *one and the same revolution;* and, where *one cause* accounts simply, completely, and with high probability, for *two* or *more effects,* it is improbable to reason that they should be the

effects of *different causes*. The mineral geology, however, does not here draw any inference from the *absence of human exuviæ*, against the Mosaical declaration—that both *man* and *beast* perished in the same revolution; because it perceives, that "*the place which man then occupied may have been* "*submerged, and his bones buried in the bottom of the* "*present seas.*" The justness of this last inference, I shall now endeavour to render manifest.

If we carry back our thoughts to that great period, and if we contemplate it in all its particulars, it will be evident; that there must have been an extreme difference in the condition of the two orders of beings, *brute* and *human*, under the circumstances of that tremendous and preternatural catastrophe. The *brute creation*, devoid of reflection and forethought, in any new and strange circumstance of nature which excites in them an indefinite sense of alarm, are prompted by their instincts merely to congregate together, and to await in trepidation the unknown evil against which their natures are unprovided with any means of preservation. These, therefore, surprised by the *successive subsidences of land* on the spots where they chanced to be assembled, would have been taken up by the inundation in its *successive progresses*, would have been launched upon the surface of its waters, and would have been carried away by its *refluxes*. Whereas, the *human population*, endowed with reflection and forethought, strongly actuated by the passions of fear and of hope, and perceiving

the progressive advances of the ocean towards them on every side by the sucessive disappearances of the *maritime lands;* would have watchfully and anxiously *retreated from the waters,* and would consequently have drawn themselves, more and more, towards the *centre* of the circumference continually diminishing: until, at length, assembled in a multitudinous mass in the narrowed central interior, they would not have been washed into the waters and carried away by any *reflux,* because they would have been *absorbed into the vortex* created by the *conflux* of the two seas meeting from the opposite hemispheres, on the subsidence of the last intervening land; and would, thus, have been immediately carried downward with violence into the profundity of the *new sea.*

If we contemplate the event in its detail, without any bias of prepossession, we must be sensible that such would have been the *most probable* course of things. And, if we add to this *natural* consideration, the *moral* reflection, that this catastrophe was designed to act with particular efficacy upon the *moral feelings* of the condemned race, we shall find reason to believe; that, whilst it was a matter of indifference how speedily the *brute* creation perished, it was essential to the dispensation that the moral sufferings of the *human creation* should be *protracted,* until it had worked its destined effect. Nor is this reflection in any way affected by the Divine declaration, that the hardened race were wholly without concern " *until* " *the day when Noah entered into the ark, and the*

"*flood came* AND *destroyed them all;*" because, the Greek and Hebrew scholar will know, that the second *and*—*και*, in this passage, is equivalent in import to the pronoun *which*: "until the flood "came, *which* destroyed them all[1]." It was not, therefore, the *destruction* that came upon them in that day; but, the *actual proof of the reality and certainty* of the destruction which they had derided, by the commencement of the disorder in creation which was to produce it. The *intelligent* inhabitants of the earth, therefore, would not, like the *unintelligent*, have been suddenly entrapped in the early stages of the inundation; but, would have prolonged their own miserable duration by their endeavours to escape from the destruction. For, the gradual progress of the waters would have allowed them measures of time for reflecting, reasoning, and acting, according to the circumstances which they witnessed and the dangers which disclosed themselves. And thus it would have happened, in one and the same revolution; that, whilst the *brute creation* were successively carried away by the refluxes from the first commencement of the inundation, and were transported and deposited in the *distant regions* where we now find their remains in great abundance, the *mass of the human population* would be suddenly and simultaneously immersed in the centre of the *new* or *present sea*, as M. Cuvier

[1] So Drusius in *Ecclus.* i. 12. "*αρχη σοφιας—και*] Hic, *και* "pro ו ponitur; hoc est, *Vau* pro ושׁ: *tritum hoc Hebræis.*"

has well conjectured; where their *exuviæ* must remain for ever, uninvestigable by man.

We cannot, therefore, by any means concede the point at the same time asserted by the same distinguished naturalist, that, if man had *existed* on the same continents as the animals to which the fossil bones pertained, "there cannot be *a single reason* "assigned why his remains should not be found "among their exuviæ[1];" nor that other point, which an ingenious follower of his theory would confidently convert into the *axiom*, "that *man*, whose "bones are not found intermixed (*with those of* "*other animals*), did *not coexist with them in time and* "*place*[2]:" because, we both discern a very *sufficient reason* why their remains might not be found together, and because we plainly perceive, that their *separation in death* is perfectly reconcilable with their *coexistence in life*, both in *time* and *place*. And certainly, it is a great evidence of the consistency of the *moral* part of the geology of the record; that, whilst a vast proportion of the *brute* race were scattered over the surface which was to constitute the *new earth*, the *moral* race, which had provoked the revolution, should have *perished in the same locality with the ancient earth on which their immorality had ratified the* CURSE.

But, although this argument may satisfactorily

[1] *Theory*, § 30.

[2] *Phil. Trans.* vol. civ. p. 110. *Letter from C. Konig, Esq. to Sir Joseph Banks.*

account for human remains not being found in quantities *at all proportionate* either to the immense population that perished, or to the multitude of animal remains which are continually disclosed; still, it would seem probable, that some *individuals*, some *scattered members* at least of that vast population, might, in spite of all their vigilance and precaution, especially in the first stages of the catastrophe, have been surprised and carried away by the waters, in the same directions as the carcasses of the brute creation: so that we might very reasonably expect, that *some few vestiges of human remains* would have occurred in the extensive range of mineralogical research. Let us, then, attentively contemplate the GREAT FACTS which have very recently revealed themselves to our knowledge; and let us inquire, whether such *vestiges* have not at length actually occurred, since the period when the two eminent naturalists above cited, pronounced that "*none had ever been* "*found.*" And first, in the *Cavern of* DURFORT, *in E. Languedoc;* of which M. Marcel de Serres has recently made a minute and luminous report in the *Bibliothèque Universelle* for *August* and *September* of the year 1823. This *Cavern*, contains an accumulation of *human bones* thoroughly ascertained, pertaining to individuals of different ages; among which, no animal remains have been found except one single *sea-shell*. The circumstances of the inhumation of these *human exuviæ*, correspond in an extraordinary manner with those of the *brute*

exuviæ discovered recently in the *Cave of Kirkdale:* the bones are accumulated *in a fractured and mingled state—not rolled—in the interior of a limestone rock—at the extremity of a long and narrow fissure of the rock, the orifice of which is little more than a foot in width—and consolidated in a flooring of stalagmite which has long ceased to increase.* From whence it would appear; that the *geological conditions* being the same in the Caves of *Durfort* and of *Kirkdale,* the solution of the problem in the *one case,* will resolve it in *the other.* For the particulars of the phenomena at Durfort, as also of those at Kösritz, I must refer the reader to the *Note,* "*On the Recent Discovery of Fossil* "*Human Remains*[1]."

The *human skeletons* discovered in a *calcareous rock* forming a part of the coast of the island of Guadaloupe, one of which is to be seen in the British Museum[2], have not hitherto been regarded as furnishing any *data* sufficient to authorise an inference bearing upon the present question; but, their importance with relation to it is now considerably heightened, by the phenomena lately disclosed at Durfort and at Kösritz.

We now perceive, how perfectly the simple thread of the *Mosaical history* enables us to arrange, and to adjust in their due order of *time* and *succession,* the *conclusions* which the mineral geology itself has been led to deduce, in part correctly

[1] See Note [IV.] [2] *Phil. Trans.* vol. civ. p. 107.

but in general confusedly, from the *phenomena*. We find, 1. "*That mankind did not inhabit the continents of Europe, Asia, Africa, and America, until after the revolution which imbedded animal exuviæ in their soils*," *because*, that revolution gave the first sensible existence to those continents; that is, "*that they did not inhabit the regions in which those exuviæ are found*," *because*, those regions then formed the basin of the primitive sea: 2. "*That they existed elsewhere*," *because*, they existed upon an earth which was submerged by that revolution: 3. "*That human bones are not found, or at least very sparingly, in the bed of the ancient sea*," *because*, the mass of the human race perished in the bed of the *new sea:* 4. we are able to determine, *That* "*the last revolution of the mineral geology, from which it dates the establishment of the societies of the present race of mankind, and which* (it is convinced) *cannot be very ancient;*" is the *identical revolution* in which God executed His menace of destroying all the former race of mankind, excepting only those individuals who should become the progenitors of a new race: And we thus perceive, 5. *That these results of physical investigation not only* "*connect, by an uninterrupted chain, Natural history and Civil history*," but, when duly rectified by the rule of the Mosaical record, *that they moreover connect both these with Sacred History.*

CHAPTER VIII.

BUT, there is still a *phenomenon*, connected with those which we have examined, for the explanation of which the mineral geology requires *more revolutions;* and that is, the discovery of the *exuviæ of animals whose species and even genera no longer exist:* this *phenomenon*, appears to it incapable of a reasonable reference to any revolution *reported by Moses.*

This is, indeed, a phenomenon well calculated to perplex a science which neglects Newton's inculcation, of combining *morals* with *physics*, and of subjecting the latter to the former; and which excludes all inquiry into *the mode of the first formation* of the *animal and vegetable structures*, confining its speculation to the formation of *one inanimate* member of creation detached from all the rest, and to *chemical* and *mechanical agencies* only. There is no *mere physical principle*, that will serve to explain *this phenomenon;* nor can it be expounded, unless by reference to the principle which alone explains the *mode of the first animal formations*, namely, CREATIVE POWER.

But, the *Mosaical Geology*, which is founded upon *that principle*, and which therein accords with the philosophy of Newton, guides us to an easy solution of this mysterious problem. The

sole cause of the *last* great revolution of the globe, was its *Creator*, who also caused its *first* great revolution; and, evidences of that *identity* were of great *moral* concernment. When God made known to Noah the animal species which He designed to preserve, "*to keep seed alive upon the* "*earth;*" it is manifest, from the testimony which we are here considering, that He was pleased to *except some from that preservation*[1]. We know that the formidable animal, the *carnivorous*[2] *elephant*, to which science has given the name of *Mastodon*, and various others, to which the names of *Palæotherium*, *Megatherium*, *Anoplotherium*, *Ornithocephalus*, *Megalosaurus*, *Plesiosaurus* (called also, with more critical correctness, *Sauroïdes*), &c., have been assigned, have *not been perpetuated*, but were ordained to *perish altogether*. He who

[1] See after, chap. xiii.

[2] M. CUVIER, has described this animal as exclusively *herbivorous;* but, his description is altogether arbitrary and systematical. We can judge of its *nature*, only by its *remains;* and, as the most striking character of those remains is found in the enormous *grinding teeth*, resembling in several respects those of carnivorous animals, whereas those of the elephant, known to be herbivorous, are very differently constructed; it is reasonable to assume, that the difference of those *organs* evinces a corresponding difference in the nature of the *food* of the two species. Cuvier observes, (*Disc. Prél.* p. 48,) that "an *herbivorous* diet, requires teeth "with a *flat* crown or surface, to grind the *seeds* and *vegetables:*" such, accordingly, are the teeth of elephants. Whereas, those of the *mastodon*, he says, "differ from these, in an essential manner, *only* by the grinding "teeth; which have a crown *rugged with protuberances* or *nobs*, more or less "numerous, more or less prominent:" (*Ossemens Foss.* tom. i. p. 205.) and yet he infers, "that the mastodon must have made the same use

planned and regulated the *Creation* of the earth, unquestionably planned and regulated also its *Renovation;* and, the *extinction of certain animal species,* which existed prior to that last revolution, is proved, by the *exuviæ* of those animals, to have been *a part of His plan in the Renovation.*

It is wisely remarked, in a passage cited from Camper by a writer whom I have recently quoted; "that it was not contrary to the Divine "Wisdom to ordain the cessation of animal "species, when they had entirely fulfilled the "purpose for which they had been created, al- "though that purpose is unknown to us:—*Sapi-* "*entiæ Divinæ non repugnare legem, qua res illas* "*vel animalia illa desinere jubeat, simulac scopo* "*primario, nobis incognito, satisfecerunt penitus*[1]." That those species existed *then,* is manifest; but, there is no evidence whatever, that they have

"of his teeth as the *hog,* and *hippopotamus,* who have the same cha- "racters in their teeth. He *must therefore have attached himself chiefly* "*to tender vegetables*—*aux végétaux tendres*—to *roots,* and *aquatic* "*plants,* but he *did not* feed on a living prey." (Ib. p. 225.) It is hardly necessary, to point out the power of *system* in this inference. The enormous force of the *grinders* of the mastodon, appears evidently to have been provided against substances of a much more resisting nature than the "*tender vegetables*" which satisfy M. Cuvier's theory. "From the "points and depressions of the teeth, fitting into each other like the "teeth of two saws, they must have been, (Mr. Peale observes,) incapable "of lateral motion, and consequently, of trituration;" he therefore inferred, "that it *must have been a carnivorous animal.*" (PARKINSON, *Foss. Org. Remains,* p. 318.) We know, that the *hog* is carnivorous, as well as herbivorous.

[1] *Phil. Trans.* vol. civ. p. 108.

existed *since*. What more probable *physical cause* can be assigned for the *extinction* of their races, than the *universal inundation*? What more probable *moral cause*, than the *will* and *design* of their *Creator*, the sole Author and Manager of the revolution, Who *excluded them from the shelter of His ark*? To our preserved progenitors, who were eye-witnesses of all its details, the exclusion and extinction of those several species must have been a subject of devout contemplation; not of that cold and barren sentiment, which their fossil remains now produce in the cabinets of *physical curiosity*. *Moral* argument, can alone reach this question; mere *physical* reasoning can no more attain to it, than the rule of *simple addition* can resolve a problem in *trigonometry*.

By ascending to the *first moral and physical cause* of Newton, we obtain a direct and intelligible solution of the question; but, with the utmost labour of search among the *secondary causes* of the mineral geology, we can never obtain it; we only encounter the same perplexity, resulting from the same imperfection of analysis, that we witnessed in our inquiry concerning *first formations*. From that *first cause alone* it has proceeded, or can have proceeded; that "*some races have ceased for ever*, "*and have left in the world only fragments which* "*the naturalist can scarcely recognise*[1]." The evidences, of *species rendered extinct*, and of *changes*

[1] CUVIER, *Disc. Prél.* p. 9, § 6.

effected in the forms or magnitudes of organised beings, demonstrate, to *rational thought*, the immediate intervention of the same Intelligent and Almighty Power who gave origin and primitive order to the general system; and present to us, for the recognition and prostrate submission of the intellect, as it were, the *Sign-Manual of the* CREATOR.

A difficulty which some of the extinct genera and species occasion to this geology, arises from the circumstance of their not being found *in the same places*, or *the same strata*, with those animals whose genera have been preserved. "The unknown species of known genera, as the *fossil elephant, rhinoceros, hippopotamus, mastodon*, are never found along with the more ancient or unknown genera, as the *palæotheria, anoplotheria*, &c.—The bones of species which are apparently the same with those that still exist alive, are never found except in the very latest alluvial (diluvial) depositions.—Whoever takes a *comprehensive* view of the phenomena will be led to conclude, *as I have done*, that there has at least been *one succession*, and very probably *two*, in the class of quadrupeds, *before* the appearance of those races which now inhabit the surface of our globe[1]." Thus, the mineral geology concludes, that the several animals *cannot have coexisted*, but must have perished in *different and dis-*

[1] CUVIER, *Theory*, § 29.

tant revolutions. Assuming the geological facts here alleged to be universally confirmed, which is not the case; yet, to resort to *different revolutions*, is as unreasonable in this case as in all the preceding. For, suppose that the *palæotheria* and *elephants* did not inhabit the *same regions* of the submerged continents, as the *camelopard* and the *kangaroo* do not inhabit the same regions in the present continents, and that they were therefore not congregated in the *same places*, which is not only possible, but highly probable; and, suppose that their races perished in *different subsidences* of land, and therefore at *different periods* of the inundation, which is equally probable; then, they would not have been carried off by the *same currents*, at the *same times*, and in the *same directions*; and then, they would not have been deposited in the *same places*. Or, if the one was deposited before the other, with an interval of time sufficient to allow the continually agitated bottom of the sea to cast up and accumulate vast masses of its moveable soils above it, before the other was brought and deposited; then, although they had coexisted, yet the one would become imbedded in deeper strata than the other.

Thus, if a revolution, similar to the last, were to cause the existing continents to subside by successive portions beginning in the south, under a sea whose *reflux* should be towards the south; and, if the bed of that southern sea were to be finally laid dry by a general discharge of its water

to the northward; the *kanguroos* and *ornithorinchi* of New Holland, would be found buried earlier, that is, deeper, than the *elephants* and *camels* of Asia; and the *elks* and *rein-deer* of Sweden, would be still later buried than the *elephants* and *camels*, or would not be discovered among the former, but in a different region: whilst *marine animals* which had for ages occupied that southern seabed, would have left *exuviæ* buried in the loose soils of its basin long before the transport of the *kanguroos* and *ornithorinchi*, and somewhat longer before that of the *elephants* and *camels*. Such an arrangement of *fossil exuviæ*, would correspond exactly to that which M. Cuvier states to exist actually in the earth. "It is clearly ascertained "(he says) that the oviparous (*amphibious*) qua- "drupeds—as the *crocodiles* of Honfleur—the "*monitors* of Thuringia—the great *alligators* and "*tortoises* of Maestricht—are found considerably "earlier, or in *more ancient strata*, than those of "the viviparous (*land*) quadrupeds—as the *palæo-* "*theria*, &c.—and in strata which indicate *a long* "*continuance of the water of the sea above our conti-* "*nents*:—whilst the *palæotheria*, &c., are found in "the most ancient formations *above these*,—which "indicate *transportations that have taken place with* "*violence*:—and the *elephants*, &c., are found in "later alluvial (*diluvial*) formations containing "shells[1]." Here then we find, successively,

[1] *Theory*, § 29. Compare the whole of this Section.

marine animals, palæotheria, and *elephants;* as, in the case proposed, we should find, successively, *marine animals, kanguroos,* and *elephants.* M. Cuvier, gratuitously assuming, *à priori,* that the *strata* in which the former are discovered were successively and alternately the *places of habitation* of all the animals, both *sea* and *land,* whose remains are found in them; conjectures from the phenomena, that there must have been "numerous revolu-" tions;" that the *amphibious*[1] quadrupeds and *fishes* were the first occupants of the globe, and that land quadrupeds, as the *palæotheria,* &c. did not appear upon the earth, until the sea animals, by the surrender of their basin, had supplied them with a *land* to dwell on: which they then occupied, until they were overwhelmed thereon by the return of the sea; which again, after a long time, surrendered its basin to the *extinct elephants,* &c.; which were also overwhelmed by the sea, until it finally retired to accommodate the *various species of land animals which now exist* on the earth.

The argument is the same with respect to *shells.* Those which would be found the *deepest,* would be the shells of the *southern sea;* because, it was their native seat which they had occupied for many ages. As that southern sea advanced northwards by the subsiding of the continents, the violence of its *refluxes* would have successively

[1] M. Cuvier does not seem to reflect, that *amphibious* animals prove the *coexistence of dry land and sea;* for, why else were they *amphibious?*

brought back shells of more northerly latitudes. And, when the continents had entirely subsided, the uppermost shells would probably be those of the new sea nearest to the shores of the new dry land; whilst those that had pertained to the former southern sea, would not be found living in that new sea. This case, M. Cuvier also states to exist in our present earth. "It is generally the case, (he says,) "that the shells of the *ancient strata* have forms "peculiar to themselves; that they gradually "disappear, till they are not to be found at all "in the recent strata, still less in the existing seas, "in which, indeed, we never discover their corresponding species, and where several, even of "their genera, are not to be found: on the contrary, the shells of the recent strata resemble, "as it respects the genus, those which still exist "in the sea; and, in the last formed and loosest "of the strata, there are some species which the "eye of the most expert naturalist cannot distinguish from those which at present inhabit the "ocean[1]." Now, we have found *a single operation* capable of producing all these *various effects*, and corresponding with the *data* of authenticated history; and therefore, an operation more probable in philosophy than the *numerous*, *unconnected*, and *causeless* operations which M. Cuvier's invention has devised. We are therefore thoroughly sensible, both of the visionary nature of the *causes*

[1] *Theory*, § 5.

which he assigns to the phenomena of changes in shells — viz. "*corresponding changes in the chemical nature of the sea*, which would have rendered it almost impossible for the same kind of animals to continue to live;" and also, of the overweening confidence with which he peremptorily asserts in conclusion — "*nor did they do so in fact*[1]." We now perceive, *how* he has been drawn into the conjectural and arbitrary conclusion, of the necessity of *numerous revolutions*. On the other hand, we have found, that all the phenomena were apprehensibly effected by *one and the same revolution*; so that the hypothesis of *different revolutions*, is neither required nor sustained by the phenomena. It is not, therefore, by endeavouring to deduce *geological theories* from *fossil animal remains*, that the illustrious comparative anatomist who has devoted so much genius and zeal to the investigation of the latter, will serve the cause of *true knowledge*; it is, by applying his *anatomical* and *zoological* skill and experience to discriminate between the *extinct* and the *preserved genera and species*, and thus, *to bring us acquainted with those animal races which the Author of Creation thought fit to exclude from His renovated earth*. But yet, even here, the temperance of science must restrain the impetuosity of system. In the opening of his "*Theory*," M. Cuvier sanguinely declares: — "I shall unfold the principles

[1] *Theory*, § 5.

" on which is founded the *art of ascertaining these* " *bones*, or, in other words, *of discovering a genus* " *and distinguishing a species by a single fragment* " *of bone—an art, on the certainty of which depends* " *that of the whole work*[1]." Nevertheless, he afterwards finds himself constrained to acknowledge, " that there are still some *doubtful* species of " these fossil bones; which must occasion some " *uncertainty* in the result of our researches, until " they have been clearly ascertained[2]." What then becomes of the art of *ascertaining*, or of *commanding certainty* by a single fragment of bone, proclaimed in the first instance? The *uncertainty* pleaded in the latter passage, was categorically excluded by the *certainty* unreservedly asserted in the former. From hence we may collect, how *uncertain* is often the *alleged certainty* of the mineral geology; and from thence we may further learn, to be cautious and wary in the measure of *confidence* which we are tempted to repose in its conclusions.

[1] *Theory*, § 2. [2] Ibid. § 29.

CHAPTER IX.

AGAIN, the mineral geology, pursuing the same fallacious course of reasoning, demands *more revolutions* to enable itself to unriddle certain phenomena intimately connected with the preceding, which are presented to it in penetrating into the different strata of the globe. "If," it says, "we examine with greater care these remains of organised bodies, we discover, in the midst even of the *most ancient marine* strata, other strata filled with *animal* or *vegetable* productions pertaining to *land and fresh water:* and, amongst the most *recent* strata, that is to say, those which are nearest to the surface, there are some in which *land animals* are buried under *heaps of productions of the sea.* Thus, the *different catastrophes* of our planet have not only caused the different parts of our continents to *rise by degrees* from the bosom of the sea, but it *has also frequently happened,* that lands which had been laid dry have been again covered by the waters, either by the sinking of those lands, or, only by the waters being brought upon them; and the particular portion of land which the sea disengaged in its *last* retreat, had already been dry *once before,* and had at that time *nourished quadrupeds, birds,*

" *plants, and terrestrial productions of all kinds;* " it had, therefore, *been inundated by the sea which* " *afterwards quitted it.* The *changes* which have " taken place in the productions of the shelly " strata have not, therefore, depended only on " *one* gradual and general retreat of the waters, " but on *successive irruptions and retreats;* the " final result of which, however, has been *an uni-* " *versal depression of the level of the sea*[1].—By " *extraneous fossils alone* we are enabled to ascer- " tain, with the *utmost certainty*, that our earth " has not always been covered over by the same " external crust; because we are *thoroughly as-* " *sured*, that the organised bodies to which those " fossil remains belong *must have lived upon the* " *surface*, before they came to be buried, as they " now are, at a great depth.—In regard to *quadru-* " *peds*, every thing is *precise.* The appearance of " their bones in *strata*, and still more of their entire " carcasses, clearly establishes, *that the bed in* " *which they are found must have been previously laid* " *dry.*—Their disappearance, as clearly announces, " that this stratum must have been inundated, or " that the dry land had ceased to exist in that " state. It is from *them* (*terrestrial fossils*), there- " fore, that we learn with *perfect certainty* the im- " portant fact, of the *repeated irruptions of the sea* " *upon the land*, which fact fossils of *marine origin* " could not of themselves have proved; and, by a

[1] CUVIER, *Disc. Prél.* p. 8.—§ 5.

" careful investigation of them, we may hope to " ascertain the *numbers and epochas of those irrup-* " *tions of the sea*[1]."

The most careful investigation *in a false track*, can never ascertain the object sought. The fossil remains of quadrupeds can, indeed, reveal to us what animals *once lived*, by shewing us what animals *have perished;* and from these we may therefore collect, what genera or what species are *become extinct*. But, this is the utmost extent of the instruction imparted by fossils extraneous to the sea. The *strata* in which they are found, can only indicate to us (as we have seen in the last chapter) the *order of their immersion* into the plastic soils of the primitive sea, which can only prove their *successive subjection to the immersing cause*. In the foregoing over-confident and temerarious conclusions of our great mineral geologist, we plainly perceive the consequence of attempting to navigate an unknown ocean *without card and compass*. Had he corrected his " morbid eagerness to separate his " reasoning from Scripture, and to seek no sup- " port or confirmation from that quarter[2];" had he piloted his course by the *Mosaical card*, he would have pursued a direct and simple track, conducting him to the haven which he sought; but, having left his card behind him, he traverses and counter-traverses the same ocean in all directions; sees the same head-lands over and over

[1] CUVIER, *Disc. Prélim.* p. 28.—§ 23, 24.

[2] *Quarterly Review*, No. lvii. p. 145.

again; and imagines that he is making a steady progress, and that all those head-lands follow each other in regular order of succession. Because terrestrial animal and vegetable relics are found buried between two strata containing *marine productions*, this eminent hypothesist (who acknowledges that these *fossils* have produced and determined his *Theory of the Earth*[1],) at once assumes, that the *actual positions* of those relics constitute positive evidences of *so many different terrestrial surfaces*, successively overwhelmed by the ocean in the order in which they present themselves; and that they therefore indicate, *as many different revolutions*. And this might be inferred with some plausibility, if no such thing was possible in the world as *disorder and confusion*, and if all substances existed, necessarily and always, in the same *original locality*. But, if that is not the case, the whole ground of the argument at once disappears.

It is perfectly surprising that it should not have occurred to this able naturalist, before he concluded that *every stratum in which animal exuviæ are found, must have been once a permanent upper surface of the globe on which the animals dwelt and were nourished*, to examine, *whether those strata reveal any character betokening such a surface;* which character, could not have been *totally obliterated*. For, the supposed *inhabited terrestrial soil*

[1] *Theory*, § 23.

must have been *firm* and *solid*, and the overwhelming *marine soil* must have been *loose* and *yielding*. Although, therefore, the loose matter might have extinguished animal and vegetable *life*, yet it could not have *entirely destroyed the solidity and structure* of the surface on which vegetable and animal life had subsisted, but must have *moulded itself upon it*. We should then have found an immediate line of distinction between the two, and the animal exuviæ lying in a bed revealing the nature of the surface on which the animals and vegetables had lived and perished; in some measure, as we find the pavements of Herculaneum and Pompeii, on removing the loose, or once fluid matter which severally overwhelmed them. But, no trace of such character is found in any of the strata in which the fossil *exuviæ* of terrestrial animals are discovered; on the contrary, these lie immersed in the heart of a desiccated mineral paste, the same above, below, and on every side; like a stone thrust into the middle of a lump of thick mortar, or inclosed within coatings of a mortar more fluid. Hence, then, there can exist *no reason* for supposing the *several strata* in which they lie to have once constituted *superior inhabited surfaces of the globe, which produced quadrupeds, birds, plants*, &c.; and consequently, there can be *no reason* for supposing, that they were there "*inundated by the sea, which afterwards* "*quitted them.*"

But, as the characters of the phenomena in

question plainly declare a condition of *disorder and confusion*, we can easily explain it from the *data* of the *Mosaical geology*. We have seen; that innumerable *land animals*, pertaining to the submerged continents, were transported and precipitated, successively and indiscriminately, into the primitive sea, and were sunk deeply within its loose and fluid soils. Now, if a *cause* can be found which might, in one and the same revolution, *cover the bed in which those land animals were thus inclosed with a fresh bed containing marine productions*, the whole difficulty will be at once removed. And, need we seek far to find such a *cause*, when we reflect upon the *powerful agency* which was in *unceasing operation* during the whole of that turbulent and destructive crisis? Can we fail to perceive, that after *terrestrial* substances had been successively *transported* from different parts of the subsiding continents, and had been *deposited;* violent and particular agitations of the restless sea within its basin, might have dislodged, ploughed up, and put in motion enormous masses of its *loose soils*, and have *driven them, loaded with marine substances, upon the beds into which the terrestrial animals had been previously sunk?* Repeated instances of similar confusion may, and *must*, have occurred in the depths of the ocean, during that disorderly and tumultuous crisis; producing *various alternations* diversified by local circumstances, and reducible to no rule of regularity and order. I need not appeal to any other authority than the author

of the "*Theory*" himself, in proof of this position: "These mineral repositories (he says) are subject "to *great doubts*, with respect to their successive "formations. — The *same formation* may seem "recent in those places where it happens to be "superficial, and ancient where it is covered "over by succeeding formations. *Ancient forma-* "*tions may have been transported into new situa-* "*tions—and may thus have covered over recent for-* "*mations containing bones; and may have mixed* "*them with productions of the ancient sea, which* "*they previously covered*[1]." Thus, he directly corroborates my argument; and all these mixtures, becoming eventually exposed to the observation of man by the removal of the waters, must be found to retain the characters of *disorder and confusion* which accompanied their formation. To trace, in their detail, *all* and *each* of the particular local effects produced, and to assign them severally to their respective *immediate causes*, is a task beyond the ability of man, whether he adopts the *Mosaical* or the *Mineral* scheme of geology; and we may therefore refer those effects, generally, and with far better title than the *latter geology*, to—"*des causes primordiales qui ne sub-* "*sistent plus*[2]*—primordial causes which no longer* "*subsist;*" and to—"*des causes que nous ne con-* "*noissons pas*[3]*—causes which we know not—qui* "*nous sont inconnues*[4]*—which are unknown to us.*"

[1] CUVIER, *Theory*, § 29.
[2] DE LUC, *Lett. Géol.* p. 73, note.
[3] CUVIER, *Disc. Prél.* p. 49.
[4] D'AUBUISSON, tom. i. p. 271.

And thus, the *one, last revolution* of the Mosaical record, will be found a certain *cynosure* to guide our course through the *whole* of this particular class of phenomena; from which the mineral geology, beating about "*sine sidere—cæca caligine,*" would hypothetically infer, "*various catastrophes of our planet,*" and "*successive irruptions and retreats of the sea.*"

The *fresh-water shells,* alleged to be found in some of these accumulations, are totally inadequate to sustain the objections which the mineral geology would ground upon them; 1. because, in the subsidence of the ancient continents, the contents of all *river-beds* and *lakes* must have become absorbed by the sea; and it is impossible to fix a limit to the transport of such light and buoyant articles as *shells,* in so turbulent and active a state of the ocean: 2. because a very just and pertinent doubt is raised by Mr. Greenough[1], and repeated by M. Humboldt[2], "whether the distinction be-"tween *fresh-water* and *salt-water shells* is so "strongly marked that they cannot be confounded?"

Another plea for requiring a concession of *more revolutions* and *more time* than are supplied by the Mosaical record, is to account for a phenomenon affirmed to have been lately discovered in Norway by two eminent mineralogists, MM. de Buch and Hausman; namely, "a *granite* or *gra-*"*nitic rock* superposed on a bed of *shell lime-*

[1] *Geology,* p. 303, 4.

[2] *Superp. of Rocks,* p. 46. "Is it possible to distinguish by precise "characters, *fresh-water* from *marine* shells?" See Note [IV.]

" *stone—calcaire coquillier*[1];" or, as M. Humboldt speaks, with more precision as to *theory*, " a *for-* " *mation* of granite, *posterior* to calcareous rock " containing remains of organised beings[2]." Now, (argues the mineral geology,) *shell limestone* is unquestionably a *secondary formation;* yet, here is granite *formed upon it*, and therefore, *posterior to it in date*, because, that which supports must always be more ancient than that which is supported. Here then is a proof, of the *actual chemical crystallisation of a recent granite;* which virtually confirms the doctrine, of the *chemical crystallisation of primitive granite:* both, required the *time* necessary for the operation of their production, and they will therefore concur to prove a period irreconcilable with the Mosaical chronology.

To this argument, I may oppose a question addressed by M. D'Aubuisson on another occasion: " Est-elle un *fait positif?* est-elle en *réalité* " ce qu'elle est en *apparence?* On pourroit en " *douter*—is it a *positive fact?* is it *in reality* what " it is *in appearance?* We might *doubt it.*" This cautionary question may be confidently asked, when it is affirmed by the same writer, that " *we* " *have only this one direct example of such a super-* " *position*[3]."

The *fact* to be explained, is simply *the appearance of a granite formed upon a limestone base;* which

[1] D'AUBUISSON, tom. ii. p. 197, 226. [2] *Sup. of Rocks*, p. 250.

[3] " Nous n'avons qu'*un seul exemple direct* de cette superposition." D'AUBUISSON, tom. ii. p. 226.

appearance must be investigated, before we can treat it as a *reality*. Yet, the mineral geology instantly *assumes* it for a *reality*, and, that the *cause* was certainly *chemical;* and, upon that assumption, it proceeds to argue the *mode* and *time* of its *formation*. But, if the true cause should chance to be *mechanical* and not *chemical*, then, all the chemical argument must fall to the ground.

Now it will be evident, that one of two *mechanical* operations will have been sufficient to cause the effect apparent in the sensible phenomenon.

1. If a mass of displaced primitive granite had been so thrown and stationed, in the *first Mosaical revolution*, as to leave *cavities* or *recesses under any of its sides*, those cavities or recesses might, during *the second Mosaical revolution*, or during *the preceding interval between the two revolutions*, have become entirely filled with marine matter, siliceous, argillaceous, or calcareous; and, during the ages which have elapsed since that last revolution, that marine matter might have become moulded and crystallised in close adhesion to the upper mass, and have become consolidated into rock of one or other of those species, presenting the *appearance* of a secondary bed on which the granite had more recently been formed. But, the alleged *superposition* of the *granite*, would thus turn out to be the *subposition* of the *secondary rock;* and the phenomenon would fail to prove, what the *chemical*

argument would endeavour to prove by it. We know so little of the bases of the granitic masses, that many which we assume to hold their original stations, may be enormous detached and displaced bulks projected in the vast primitive convulsion which modified the creative frame-work of the globe; and these, from ignorance of the cause of their irregular localities, will be supposed to be granites of a later epocha.

Or, 2. If, in the violent circumstances attending or concluding *the second revolution*, any dislocations of that *fractured frame-work* took place, as in the *first* revolution; the overthrow and projection of a granitic mass on the *bed of the sea* already abundant in *marine matter and organic productions*, would occasion the same sensible appearance at the present day; and we know, that *shell limestone* constitutes the soil of many parts of the Scandinavian peninsula[1]. Thus, then, a *mechanical cause* was capable of producing the sensible effect, which the mineral geology determines arbitrarily to *chemical causes*, aqueous or igneous; thereby nullifying its induction. "M. Hausman "saw nothing in this phenomenon but a *neptunian* "*origin:* M. Humboldt appears inclined to view "it as a *volcanic effect:* M. de Buch, only found "in it the subject of *an enigma which we should be* "*a long time embarrassed in attempting to explain*[2]."

[1] JAMESON'S *Mineralogy*. Ind. *Shell limestone*.

[2] D'AUBUISSON, tom. ii. p. 241.

The high reputation of M. de Buch is here well sustained.

And it is the more surprising, that the possibility of this *mechanical cause* did not suggest itself to our able mineralogist; because he himself reports, that immense fragmentary masses of *primitive rock*, of double the bulk of the Norwegian granite[1], are found in the Alps and in all the plains of the north of Europe, which have been disunited from the parent mass, and have been "evidently transported" to a bed of *secondary formation*. This fact, the *Mosaical geology* guides us to interpret. The *mineral geology*, is constrained to ascribe all such *transports* to the agency either of *water* or of *fire;* because, it can find no other impulsive force of equal power. Now, if in the *first* Mosaical revolution, by which the primitive sea-bed was formed, the convulsion which caused so general a breach and depression of rocks and soils had shattered and separated some masses of *primitive rock*, without dislodging them from their base; and if, in the agitations of the ocean in the *second* Mosaical revolution, when it was draining from its former bed, its violence at length displaced any of those separated portions from their base, and projected them into the sea-bed in which *secondary formations* had been in course of production for 1656 years; then the result must have exhibited the general phenome-

[1] D'Aubuisson, tom. i. p. 231, 232.

non which is to be explained, whether in Norway or in the Alps; varying only in details, equally open to investigation. It will therefore be wise, to observe the caution which the same mineralogist prudently enjoins upon this subject: "Let "us *wait*, until a positive and accurate observa- "tion has *proved*, directly or indirectly, the su- "perposition of a *granite formation* upon strata "containing relics of organic beings (that is, *the "true production of a new granite upon such strata*); "before we displace it from the class, to which "observation has hitherto assigned it[1]." The peculiar complexity, yet, at the same time, uniformity and universality of *granitic composition;* the *essential* function which it discharges in the fabric of the globe; and its total irrelation to any secondary cause or agency that we know, or can philosophically assume; exempt it, wherever it may appear, from all rational supposition that it is the formation of a *secondary cause*. The *mode* of the *composition*, necessarily precedes, in the order of philosophical and rational contemplation, the *mode* of the *crystallisation*[2]; and, the mind will evince its *philosophy*, in proportion as it recognises in these "*the subject of an enigma*" incapable of solution, except by ascribing both the *composition* and its *crystallisation*, simultaneously, to the primitive *Creative Act*, equally powerful to produce the *form* as to produce the

[1] D'AUBUISSON, tom. ii. p. 199. [2] See above, vol. i. p. 92—94.

substance—ὡς ισχυρα εποιει τα θεμελια της γης—"*when* "*He made* SOLID *the* FOUNDATIONS *of the earth*[1]." The accidents of granite *in decomposition*, and the forms which its decomposed parts may acquire, is a point totally unconnected with this question[2].

[1] Prov. viii. 29.

[2] D'AUBUISSON, tom. i, p. 314, 315. "Werner pense que la divi-
" sion en boules que présentent quelquefois les granites, est la suite d'un
" *mode de formation*, &c.—Quant à moi, je suis très-enclin à croire que
" la forme de ces boules n'est qu'un simple effet de l'*action décomposante*
" *de l'atmosphère*.—M. Mac Culloch *concilie les deux opinions*, et tout en
" insistant sur les effets de la *décomposition*, &c. *On the granite Tors of*
" *Cornwall*."

CHAPTER X.

THE *forms of valleys*, exhibit phenomena which, in the view of the *mineral geology*, suppose *physical* operations that cannot be limited to the periods of time and the revolutions represented in the Mosaical geology and chronology. It is especially in the *formation of valleys*, that this science observes: "*Time*, which has such narrow limits for "*us*, has none for *Nature*; for *her*, it is as inde- "finite as *space*: both surpass even the concep- "tion of our imagination[1]!" In assigning, therefore, a *cause* for those formations, it makes the *indefiniteness of time* answerable for the soundness of its conclusions. To reduce that indefiniteness of time into *finite parts* and *smaller measures*, it has suggested, for our convenience, what it terms *ecliptic days*, borrowed from the archives of the *old Chaldaic philosophy*: "*If* (it says) the different "*epochas* or *revolutions* in which our planet was "reduced from a *chaotic state* to its present habit- "able form, *be measured by those great ecliptic* "*days*, (*each consisting of above* 20,000 *years*,) "*sufficient time will be allowed for the various* "*changes*[2]." This is very accommodating; but, one material thing is here *forgotten*, which defeats the

[1] See above, vol. i. p. 29. [2] BAKEWELL, *Elem. of Geol.* p. 429.

whole intent; and that is, to inform us *who it is that has authority, either to use that measure, or to make that allowance:* for certainly, it is not left *ad libitum* of the mineral geology.

There is no article in geology, in which the *mineral system* betrays more manifestly its need of *a guide* to conduct it, with relation both to *fact* and *time*, than in speculating upon the *causes* which produced *valleys*. Let us hear it pronounce its own speculations upon this subject. "The "*disposition, direction,* and *structure* of valleys, "their *form*, the *stratification* of the mountains "which border them, are *indications of their* "*origin*. Every body has remarked the *manner* "in which *rain-water*, especially after a violent "thunder-shower, *furrows the surface* of hillocks, "or any ground presenting a *sloping* surface. In "the disposition of these *minute ravines* relatively "to the declivity on which they occur, in the "sinuosities and deviations of their directions, in "their ramifications, in the form of the portions "of soil interposed between them, &c. we possess "the *most faithful representation of the facts of the* "*same kind, which are presented by valleys and* "*mountains*. In examining in our cabinets the "*models in relief* of mountainous chains, we *seem* "*to behold* some of those very hillocks *furrowed* "*in the manner which has been described:* the per-"fect *identity* of the delineation, *leads us naturally* "to admit the *identity* of the cause. At the sight "of this singular disposition and ramification of

" valleys, we cannot but acknowledge, with " Mr. Playfair, '*that it is the stroke of the same* ' *instrument often repeated, that has engraved these* ' *characters so deeply on the surface of the globe;*' " and this is, above all things, the *erosive and de-* " *composing force of water*. With respect to *my-* " *self*, it is *impossible for me to doubt it*, when, " stationed in a chain of mountains, I consider " all these characters, that is to say, the *valleys* " of different orders and their *gorges;* and when " I see them all, even to their last ramifications, " directed according to the line of the greatest " declivity of the sides of the mountains. For, " in fact, the waters are *capable* of producing the " effect; they *tend* to produce the effect; and " every thing is *as if they had actually produced* " *it*[1]."

In the passage just quoted, the eager author is unconscious of the *equivocation* under which he reasons, by employing the term *identity* in one sense in his premises, and in a different sense in his conclusion. By *perfect identity* of delineation, he can only intend, comparatively, *exact resemblance;* but, by *identity of cause*, he intends, positively, the *same operating agent*. His proposition, therefore, released from its equivocation, is this: " the *exact resemblance* of the delineation, leads " us naturally to *admit the identity of the cause;*" or (as he speaks in another place), " we can so

[1] D'AUBUISSON, tom. i. p. 245, 6.

"*represent it to ourselves*[1]." Nothing can be more *fallacious* than this argument; and there is nothing against which reason ought habitually to guard itself with more vigilant circumspection, than *general and superficial resemblances* which tend "*to lead us naturally to admit identity of cause.*" I have urged this principle, the soundness of which daily and hourly experience confirms, in the first part of this disquisition[2]; and perhaps a more striking example to establish its importance could not be found, than this which this able mineralogist has here inadvertently afforded us.

In this scheme of geology, the *origin* of *valleys*, and of *beds of rivers*, are ascribed to *one and the same cause;* namely, the action of water eroding and excavating, "*avec le tems*[3]—*with the aid of* "*time,*" both the valleys and the river-beds. The excavation of the *river-beds*, was therefore a *continuation* of the effect of the excavation of the *valleys* out of which the rivers proceeded; and the erosion of the *valleys*, according to this hypothesis, was accompanied by the erosion of the *channels* or *beds* which carried off the waters that are supposed to have *formed the valleys;* so that the *river-beds*, equally with the *valleys*, answer to the *minute ravines* furrowed by the erosive and decomposing power of the *rain-water.* The question, therefore, proceeds from the power of water

[1] See above, vol. i. p. 89, note.
[2] See above, ibid.
[3] Comp. D'AUBUISSON, tom. i. p. 108, 9, and 237—40.

to erode and excavate, *generally;* but it terminates in its power to erode and excavate *the channels of rivers, in particular.*

With respect to the formation of *the valleys* by the operation here assumed, Mr. Professor Buckland has made the following able remark: "striking examples of valleys, extending upwards far above the highest springs that take "their rise in them, and forming vast diluvian "furrows—may be seen:—it is obvious, that "*such valleys* cannot possibly be attributed to the "action of springs or rivers that now flow "through them, since they often take their origin "*many miles above even the highest springs:* their "magnitude and depth bespeak the agency of a "mass of waters infinitely more powerful than "even the most violent water-spouts of modern "times could produce: their form also, differs "entirely from the deep and precipitous *ravines* "*which are excavated by mountain torrents:* and— "unless we can suppose a series of water-spouts "to have fallen universally and contemporaneously, not only over the district under consideration but over the *whole earth,* they will "afford no solution of the phenomena of these "and similar contemporaneous systems of valleys, "which occur on strata that are similarly circumstanced in every part of the known world[1]."

Let us now consider that supposed operation in

[1] *Reliq. Diluv.* p. 256, 7.

the case of *river-beds*, with some attention; because, if physics and sound reasoning should find that it is an operation totally impracticable in *this case*, it will go to confirm the impracticability of the operation in *the other case*. Now, it will be plain to reflection: 1. That there is no known *power* or *law* in what we denominate *nature*, by the operation of which the waters of a river could form for themselves a *bed*, such as are the actual beds of rivers, in a surface *originally compact*, *extended*, and *nearly horizontal*. 2. That the waters of rivers would never have reached the distant points at which they now discharge themselves into the sea, if beds *leading to those points* had not *previously* been opened to conduct them thither. 3. That there would, consequently, have been *no rivers* on the globe, if river-beds had not been *provided* anterior to the procession of their waters.

1. It is granted, that a mass of waters descending from a mountainous ridge, through a passage determining the first diameter of its bulk, would form a column of water whose *weight* and *force* would make a breach in the surface that should receive it; and, that the descending waters, whilst *laterally confined*, would, by the same mechanical action, extend the breach and plough up the soil, to a certain extent and within a certain angle of declivity. It might, also, by the same power, and by its erosive quality, *enlarge an aperture into which it should be directed by an existing channel;* as in the *particular* case adduced by M. D'Au-

buisson, to prove the *universal* power of water for originally excavating beds of rivers: where, near the sources of the *Ardèche* in the high Vivarais, a stream, whose granite bed had been choked by an ancient volcano, had worked itself a new bed, not in the *upper surface of the lava*, but, *between the lava and the granite*[1].

But, let us suppose a flood of waters to descend *for the first time* from a mountainous source, and to arrive *for the first time* at an horizontal, compacted, expanded, and *unchannelled surface of plain*, propelled by the waters continually following with equal and unremitting violence and rapidity, and diverging by the expansion of the lowest valley; and what would be the necessary consequence? If the *first head* of those waters found *no bed* ready to receive and confine them, and to *guide* their course, they would diffuse themselves *laterally* and *equally*, in all directions, *over the horizontal surface;* and, flowing in a state of wide and uncontrolled inundation, they would follow the first and nearest declinations. How could they possibly form for themselves, in the *first instance*, a narrow and confining channel *below* that horizontal surface, and between upright banks continuously paralleled, as by an artist's line? Let any one, for instance, survey the course of the Rhine from the tower of Godesberg, and contemplate that majestic river

[1] Tom. i. p. 241.

journeying in his view for upwards of thirty miles, from the *Seven Mountains* to Cologne, through a vast and level plain, and within a *bed* whose *uniform breadth* appears in the distance like an *azure riband* drawn along that plain; and he will be sensible, that no operation of *wild and diffusive waters* could ever have *reduced* them *within the particular line of soil*, in which he sees the flood of that river now necessitated to flow. Such diffusive waters might have formed a *lake* or a *morass*, but they never could have formed such a bed or channel.

For, let us only consider, with some reflective attention, *what the bed of a river is*, abstracting the water. It is a vast and extensive *trench*, preserving general proportion in its width. We know how such a *trench* must be made; the soil must be *dislodged* between two corresponding lines, by beginning at one end and successively displacing the matter which is to be removed. If we *will* suppose that *trench* to be formed at first by the operation of *water*, we must not content ourselves with an indolent and general cast of the *imagination;* we must submit to the *pains of tracing the operation*, so as to satisfy the demands of the *reason*. Let us, then, suppose the streams, whose confluence produces the Danube, discharging their waters for the *first time;* and let us follow in thought those collected waters, until they *first* attained an *horizontal surface* in which was no *bed* or *channel* to receive them. If we suppose them to begin the

work of excavating a *continuous trench* at that point, we must first determine, whether the operation was *mechanical* or *chemical;* whether the waters acted upon the materials to be removed by the *impulse of weight*, or by the *decomposition of erosion*. Whichever process we fix upon, we must at the same time suppose, that all the waters in the rear were *kept back*, and suspended in their flow, during that tardy operation; and that they were only permitted to advance, in proportion as the *pioneers* in front proceeded in opening the *trench*. We must suppose, that they worked with a previous design to conduct the trench to the point of the *Black Sea*, at a distance of *seven hundred leagues*, and often through a level country; that the waters filed successively and orderly into the trench in proportion as it was opened for them; and, that the parent sources did not deliver out all their stores in unrestrained measures, until the trench had been perfectly conducted to its outlet at that sea. All this we must suppose, and suppose some unknown process by which water can *bore without overflowing its channel*, if we *will* suppose the first waters of the Danube to have *worked out that bed* in which they now journey to the Black Sea.

But, as this supposition would be manifestly *absurd;* let us consider, what would *really* have been the case. If the head of the Danube, on its first reaching a compacted and plain surface, came with any power, chemical or mechanical,

tending to displace the soil which it there first encountered, the violent, rapid, and multitudinous mass of waters immediately and continually succeeding, would have allowed it *no time to indulge the tendency* of either of those powers; but, would have overruled them both, and have frustrated the operation by compelling the first waters to advance, and obliging them to diverge with equal force on all sides; and thus to *gain their equilibrium upon the surface by the laws of hydrostatics,* before any progress could have been made in the process of *boring* or *furrowing a trench within it.*

The case of a river *already confined between banks,* and by its concentrated weight propelling in the same plane *loose alluvial soils* and thereby changing the direction of its course; can afford no analogy whatever to a mass of tumultuous and rapid waters flowing forward, perpetually and without any confinement, *over* an expanded and closely compacted surface.

But, if the trenches in which rivers flow were *their own work;* if their beds are the consequence of "*the strokes of the same instrument often repeated;*" how has it happened, that since the instrument supposed has been always *repeating its strokes* and is still striking them, it has not *proportionately extended its work?* for, though the erosion of *valleys* has ceased, the erosion of *river-beds,* which are only the processes of the valleys, and their erosion the continuation of that of the valleys, is still going on. If, then, such was truly

the cause, the beds of all rivers ought now to be of precipitous depth and of estuareous width; since a *cleft* always grows *deeper* and *wider* at each successive blow upon the wedge. Whereas, we have no reason to believe, that the Rhine is deeper or wider now than it was in the time of Cæsar, or the Euphrates than it was in the time of Cyrus. This, then, could not have been the *cause* which originally gave to those rivers their *beds*, otherwise it would have progressively increased its effect. In truth, we might with equal reason suppose that the *sea eroded its bed* in the surface of the globe, as that *rivers eroded their beds* in the same surface: the cause of *each*, must be *one and the same*.

2. It follows then, that the waters of the earth, flowing originally without confinement, would have followed the *nearest declivities*. The sources of the Danube discharging their waters on an *untrenched surface*, would never have had any relation with the particular remote point of the *Black Sea*; because, many intervening *passages* and *declensions*, from which those waters are now precluded by the *restraint of their banks*, would have drawn them in *other directions*. And the same is to be said of all other rivers, which would never have reached the particular points to which the *confinement and artifice of their beds now conduct them*.

3. Consequently, there would have been *no rivers on the globe*; but, the earth would have

presented a surface exposed to, and unprotected against, an *universal inundation of its waters continually accumulating*.

Since, then, the *mere action of water* could not, either chemically or mechanically, have eroded or excavated the *beds of rivers;* and since the erosion and excavation of river-beds, are assumed in this hypothesis to have been the sequel and continuation of the erosion and excavation of *valleys;* we are directed by reason to conclude, that the cause thus shewn to be *essentially inadequate* for effecting the *latter part* of the system, could not have been the true cause of the *former part:* especially, since we can discern an *adequate* cause, *common* to the formation both of valleys and river-beds, and resting upon far more solid ground of evidence than any which mere *physical* speculation is able to adduce.

The systems of valleys and mountains are evidently *coordinate* and *correlative,* and mutually suppose each other; a *mountain,* signifies nothing but an *elevation above a valley,* and a *valley,* nothing but a *depression below a mountain;* and, as *valleys* signify narrow depressions between mountains, so *plains* signify extensive depressions between chains of mountains. The surface of our earth, is thus always described by *relative comparisons of height within itself.* This diversity of surface we have traced, in the preceding discussion, to *two causes:*

1. To a primitive violent *depression* of parts

of the terrestrial surface, leaving other parts *stationary* on their primitive bases; the *latter* of these, are the *primordial mountains* of the earth, the *former* are its *first order of valleys and plains.* This great operation was effected by the *immediate* power of God, in the FIRST REVOLUTION of the globe; with the *proximate* design, of forming a *bed* to receive the *waters of the primitive sea.*

2. To a vast displacement of the *loose soils of that primitive sea:* partly, whilst it continued stationary, and partly, during its retreat in the SECOND REVOLUTION, when, diminished in quantity, and bearing its turbulent mass towards its *new bed,* its billows ploughed up and propelled immense portions of its *ancient bed,* thereby excavating deep hollows, and raising vast accumulations. For, as the mineral geology truly observes; "the immense floods of the sea must "have produced, *upon the soils on which they* "*acted,* effects proportioned to their mass and "rapidity. Currents, which displace sand-banks, "undermine rocks, and open straits, are able to "*transport* materials deposited on the bottom of "the sea; to *furrow* a soil devoid of consistence; "and to *excavate submarine valleys*[1]." By these mighty agents, were produced those *valleys* or *plains* which *intersect* heights of secondary formation whose denuded strata *correspond to each other;* the substances of which, though now com-

[1] D'AUBUISSON, tom. i. p. 220. See also, *Reliq. Diluvianæ,* Append. *On the Excavation of Valleys of Diluvial Denudation.*

pact and solid, were soft and incohesive when the oceanic currents violently displaced and expelled the intermediate portions of their masses. These, form the *second order* of high and low levels which we witness upon the terrestrial surface.

But, although the formation of *a bed for the primitive sea* was the *immediate* object of the divine plan in the *first revolution*, yet we have seen, that the same Intelligent and Provident Agent had an *ulterior* and *more important* end in view in that formation; namely, that *that bed* should become, at a future period, the *habitation* of the principal generations of mankind, and the *theatre* of the chief *moral transactions* for which He had created their race. When we contemplate the stupendous operation by which He first *opened a receptacle for the universal waters;* when we trace, in thought, the immediate effects of the primitive disruption and infall of a portion of the continuous surface, to form that receptacle; when we reflect upon the *sudden breaches* thus made in its regularly arranged materials and general frame-work, upon its fractured and crumbled parts, and upon its loose soils discharged and scattered over its lowest bed; the mind, at first, perceives nothing but a scene of *ruin and devastation* of a work just before created in *perfect order and regularity;* it is confounded by the appearance of a *contrast* so extreme, as the *work of destruction* and the *wisdom of the Artificer;* and, if it judges by the rule of its own puny conceptions, it is prompted to exclaim,

" *could* so violent a revolution be found necessary " to accomplish the plans of *Infinite Wisdom*, " almost in the very moment of creation itself[1] ?" But, when it proceeds to the consideration, that this operation of *apparent destruction* was governed by the *same Wisdom*, " *whose ways are not as our* " *ways, neither His thoughts as our thoughts*[2]," and, that it was directed with a view to a *future purpose* which it has so admirably attained, and for which it is so perfectly adapted[3]; that it was contrived with the design, that *the bed of the primitive sea* should eventually become the theatre of a *second* human race, as *the bed of the primitive abyss* had been made the theatre of the *first* human race; and consequently, that the apparent ruin was conducted on a *plan* which should produce the *best means* of supplying the wants and accommodating the subsistence of that race; that the breaches then made, were effected in such a manner as should, among other ends to be attained, constitute an universal and perfect system for supplying the surface of the future earth with the *waters* indispensably necessary to sustain animal and vegetable life; for *facilitating intercourse* between its future inhabitants; and for producing every kind of culture requisite for their

[1] *Brit. Crit.* April 1824, p. 392.—See above, p. 38, 39. [2] Isa. lv. 9.

[3] " When we perceive, that the secondary causes producing *these* " *convulsions* have operated—*not at random*, but with direction to bene- " ficial ends, we see at once the proofs of an *overruling Intelligence*." BUCKLAND, *Vind. Geol.* p. 18, 19.

necessities, by *various and different inclinations of the terrestrial surface;* it contemplates that *first revolution* with admiration, when it meditates upon the *providential skill* manifested in its *final results*[1]. When we examine the innumerable *monuments of that primeval ruin* in the highest mountains of the globe, we find their very *forms* rendered now essentially necessary (to borrow the language of the mineral geology,) "*for separating the beds of rivers;* "*and for preserving in their perpetual snows the* "*reservoirs that supply their springs*[2]."

[1] "A great majority of the strata having been formed under water, "and from materials evidently in such a state as to subject their "arrangement to the *laws of gravitation;* had no disturbing forces "interposed, they must have formed layers almost regularly horizontal, "and therefore investing in *concentric coats* the nucleus of the earth. "But, the *actual* position of these beds is generally more or less *in-* "*clined to the horizontal plane,* though often under an angle almost "imperceptible. By this arrangement, many strata affording numerous "varieties of mineral productions are made to emerge in succession on "the surface of the earth; whereas, the inferior must have been buried "for ever beneath the highest, had their position been strictly hori- "zontal.—Moreover, in the benevolent provision of almost inexhaustible "stores of *salt* and fuel—in causing the vast repositories of *coal* to be "accumulated from the *wreck and ruins* of disturbances that affected "our planet *long before* the existence of the human race—in these, and "in a thousand other examples that might be specified of *design* and "*benevolent contrivance,* we trace the finger of an Omnipotent Archi- "tect." *Vindic. Geolog.* p. 11, 12. In this equally pious and philosophical representation, I must beg leave to protest against the qualification of "*long,*" prefixed to "*before,*" which is *hypothetically* introduced, and is contradicted by *history of the fact:* as we have sufficiently seen. With more pleasure I refer the reader to this able writer's interesting exposition of the benefits resulting from the *faults* or *fractures* in coal-beds, in his note to the same work, p. 19.

[2] See above, vol. i. p. 81.

When we consider these objects by the rule of the *Mosaical geology*, we find no difficulty in solving the problem, of the *origin of valleys and beds of rivers*. "By what *miracle* (exclaims the "mineral geology) have the *depressions*, which "are supposed to have produced the *transverse* "*valleys*, been made perpendicular to the moun- "tainous chains or ridges, and *with a view to* "*that chain*? *How* have the depressions of the "secondary valleys been made perpendicular to "the branches of the chain, and with relation to "their summits? *How* did those depressions "produce all the *ramifications* by which the "valleys lose themselves at last in those ridges "and those summits[1]?" That is, in other words, *by what miracle has such correspondence of parts been observed in the depressions*[2]? I answer, according to the philosophy of Newton, *by no miracle*; but, by the operation of the *first physical principle* of all things—the intelligence and power of the Creator, Who has formed and disposed *all* His works, both primitive and secondary, with *similar correspondence of their parts*. Whence is it, that this *first principle* is so constantly and habitually overlooked by the mineral geology? Is it, that the object itself is *too small*, or *too remote*, for the mental eye to perceive it? Or, is it rather, that the mental eye is become, through want of exercise, *too dim to perceive it*? The term *miracle*, is pro-

[1] D'AUBUISSON, tom. i. p. 249, 250.

[2] Comp. vol. i. p. 47, note 2.

perly applicable to those acts only which the Creator may think fit to exercise in His physical world, in opposition to, in suspension of, or without the ministery of, the laws which He ordained for its *continuance* after He had created and completed it; not, those which He exercised in creating and completing it. For, the combined action of *His intelligence and power* is as necessarily the *first principle* in *universal physics*, as the *attraction of gravitation* is the *first principle* in a subordinate branch of physics; which last resolves itself into the former[1]. And, however admirable and amazing to our contemplation the exercise of those combined attributes may be, yet it is not *miraculous*, according to the proper employment of the term; because, the mind cannot apprehend the *origin of any thing* without recognising it.

The varied system of *valleys*, and their intimate and direct relations both to *mountains* and *rivers;* which the mineral geology perceives, but for which it is at a loss to account; are referrible to, and can only be explained by, that great *first*

[1] "That quality (observes a sound physical philosopher of the school "of Newton,) by which all heavy bodies tend towards the centre, acce- "lerating their motions the nearer they approach to it, *true philosophy* "has shewn to be unsolveable by any *hypothesis*, and resolved into the "*immediate Will of the Creator*."—"Though it is out of the reach of "human capacity to explain physically and mechanically, how matter "becomes endued with this universal property, and we are therefore "forced to resolve it into the *Divine Pleasure and Agency;* yet it is "a property our senses are so continually witnesses to, that none, who "are not resolved to be sceptical, can doubt it."—QUINCY, *Dict.*, and *Dispensary*, p. 2.

principle. And, why then is it at a loss? Because, it traces a superficial and illusive resemblance, between the courses of *valleys* and the *streams* which they send forth, and those of the *furrows* fantastically drawn by rain-water upon the surface of a sloping ground after a thunder-shower. But if, instead of thus surrendering the *rational* faculty to the first importunities of the *imaginative*, and instead of contracting the thoughts to the "*models in relief*" of particular mountainous chains and their systems of valleys and streams, it had expanded them to survey the *universal system*, as it is delineated upon a globe or map of the *whole earth*; and if, instead of comparing that delineation with the rambling furrows of the thunder-shower, it had compared it with an *anatomical delineation of the vascular system* by which the fluids necessary to *animal* and *vegetable life* are transmitted to every part and extremity of the animal and vegetable structures; it would have found *another resemblance*, disclosing *another principle of analogy* by which to argue, and which would have caused it to reject, at once, the inadequate and unphilosophical argument grounded upon the delusive resemblance of the *rain-furrows*.

It would then have found, that those reasoned with *most philosophy*, who anciently drew their conclusions from the principles of the *Mosaical geology*. The position, "*when the*

"*waters gushed out, the streams overflowed*[1]," "is undeniable in physics. That "*every thing* "*shall live, whither the river cometh*[2]," is equally undeniable in physics. But, if "*the streams* "*had overflowed*" without confinement and direction, many things, and many portions of the earth, must have perished; because, "*the river* "*would not have come to them;*" because, the unconfined waters would either have stagnated in inundation, or have pursued the nearest declivities tending to the sea. Therefore, that "GOD—*Who* MADE THE SEA[3]—CUT OUT THE "RIVERS, *also, among the rocks*[4], *and sent the* "*springs into the valleys*[5];" that "HE CLEFT "THE EARTH *with rivers*[6];" that "HE CLAVE "*the fountains and torrents*[7];" was the inevitable conclusion of those who were taught by a geology deduced from the principles of Moses, in exact coincidence with the conclusions of Bacon and of Newton.

Nor did the *consequence*, and therefore the *end* of this admirable arrangement, escape their discernment; for, "*all the rivers run into the sea, yet* "*the sea is not full; to the place from whence the* "*rivers come, thither they return again:*" or, more precisely, "*to the place whither the rivers go, they*

[1] Psalm lxxviii. 20.
[2] Exod. xx. 11. Psalm xcv. Jonah, i. 9. Acts, iv. 24, &c.
[3] Job, xxviii. 10.
[4] Habak. iii. 9.
[5] Ezek. xlvii. 9.
[6] Psalm civ. 10.
[7] Psalm lxxiv. 14.

"*return to go thither again*" — εις τον τοπον οὗ οἱ χειμαρροι πορευονται, ἐκει αὐτοι ἐπιστρεφουσι του πορευθηναι[1]. The first direction of the waters, from their *sources* into the *valleys;* their *process* from the valleys along the plains, and *below the surface* of the plains, to their respective *seas;* from which general receptacle they are again raised by *evaporation* into *clouds,* which are returned by the *winds* to the *mountainous chains,* and, in the form of *rain,* or *snow,* continually replenish the *sources* in *perpetual circulation;* these, constitute a system so profoundly stamped with the characters of *intelligence* and *power,* that they can never be attributed, by any one whose mind is in the smallest degree imbued with Bacon's or Newton's philosophy, to any other *cause* than that which originally caused the universal system of *animal and vegetable life* which that *circulation of waters* is destined to sustain; and which, likewise, contrived the *ducts* and *channels* in which the *circulating fluids of the first animal and vegetable structures* were conducted throughout their respective systems: so

[1] Eccles. i. 7. The *continental physical philosophy* will do wisely to reflect upon this *physical proposition,* advanced as a truth familiar, not only to the royal writer, but, to all his contemporary Hebrew readers. Nor can any doubt be entertained with respect to its interpretation; for, it is introduced as one of three examples drawn from the *phenomena of nature,* to illustrate the moral maxim — that "*the thing which hath been shall be; and there is* "*no new thing under the sun.*" — "The *sun* ariseth, (says the royal "Hebrew philosopher,) and the *sun* goeth down, and hasteth to his place "whence he arose. The *wind* goeth toward the south, and turneth about "unto the north; it whirleth about continually, and returneth again "according to its circuits. *All the rivers* run into the sea, yet the sea is

intimate and inseparable was *the* MODE *of first formation* in all the *three kingdoms* of terrestrial matter. If, therefore, the mineral geology asks, what was the *mode* of the first formation of the *fluvial circulating system;* I reply, that it was *the same* as that of the formation of the *first vascular circulating systems.* If it will name to me *that mode,* I will also name to it the *mode of the former;* if it hesitates, or replies *ουκ οιδαμεν* —"*we cannot tell:*" I also shall reply, after the highest example, *ουδε εγω λεγω υμιν*—"*neither "tell I you!*"

Is it not astonishing, that the author of so masterly a work as the section "*of mountains and "chains of mountains*" in the *Traité de Géognosie,* should conclude by ascribing the admirable and stupendous *fluvial system* to the same *blind cause* that furrows a sloping footpath after a violent shower; rather than to the *Intelligent Cause,* which contrived and executed the *vascular system* in created animals and vegetables? especially, since he dwells much upon the rules for forming

"not full; to the place whither the rivers go, they return to go thither "again." The *continental philosophy,* may perhaps be the more induced to attend to this subject from the consideration, that the royal author did not only write 3000 moral proverbs, but moreover, composed *physical treatises,* on *plants,* on *cattle,* on *birds,* on *reptiles,* and on *fishes* (1 Kings, iv. 32, 33); and that, before the voice of *Homer* had been heard in Ionia, and centuries before *Anaximenes* had speculated on the "*forma-"tion of the earth from air and infinity.*"—"Sapientiam Dei exponebat "(Salomon) *physiologicè* ex omni ligno, et de omni herba, et de vola-"tilibus omnibus, et de quadrupedibus, et de piscibus."—SENIORES *apud* IRENÆUM. ROUTH, *Reliq. Sacræ,* tom. i. p. 44.

a *correct chart* of that fluvial system, namely, the *rivers of the globe*[1]? How could such a *delineation* combine itself in his superior mind with that of the *fortuitous rain-furrows*, and form no combination at all with the *delineation of the arterial and venal conduits*, to which they bear so much sounder and more *philosophical* an analogy[2]? From whence can have proceeded so strange an oversight in a writer, than whom no one has displayed more ability, acuteness, general circumspection, and integrity? It has proceeded, solely, from the *seduction of* SENSIBLE PHENOMENA, *in physics;* and from a neglect to inquire,

[1] D'AUBUISSON, tom. i. p. 111, 115.

[2] "The general structure of chains of mountains, in the direction of "their summits and lateral branches, *resembles* (says this same writer, in "another place,) *that of the quadruped frame.*—The *branches* are dis- "posed with relation to the *chain*, as the *ribs* of the latter are disposed "with relation to the *spine*: the *central summits* represent the *vertebræ* "or prominent parts of the spine, into which, like the ribs, are inserted "the opposite and corresponding branches.—The surface of the con- "tinents, is *channelled by a vast number of rivers*, each of which receives "the waters that fall and flow through a certain extent of country of "which it occupies the inferior part, and of which the point where "it discharges itself into the sea is the lowest. In proportion as the land "recedes from the mouth and borders of the river, it rises gradually "(ascending above the streams and rivulets that carry down their waters "to the river,) to the highest sources; until it finally attains the summit "of the flank or side of the chain on which those waters have fallen. "Beyond that summit, the land declines again; and the waters which "flow on that other side, direct themselves to other rivers, and appertain "to other districts." (Ib. p. 68, 89, 112.) Why then does he not here apply his own principle—"*the identity of the delineation in the "mineral and animal structures, leads us naturally to admit the identity of "the cause?*"

philosophically, into their *real competency to reveal the* MODE *of* FIRST FORMATIONS.

However "*naturally*" the rain-furrows may tend "*to lead us to admit an identity of cause*" with the formation of valleys, it is certain, that it is in the highest degree unphilosophical (to say the least) *to suffer ourselves to be so led by them.* If we view the subject from higher ground, we must at once disclaim the conclusion[1]. This is a case, in which the *contradiction of fact and phenomena*[2], is easily detected. If we had nothing else to consider, but how the earth's surface might be furrowed by streams of water having *no reason* for their course, it would be of minor consequence to contest the analogy, or to point out its deficiencies; but, there is an essential disparity in the *effect*, and therefore, there must be an equal disparity in the *cause*, of the two operations. The rain-water which runs down a sloping footpath, works its way *at random;* it is a matter of *indifference*, every inch it moves, whether it travels on this side or on that side, in this direction or in that direction; but, how widely different are

[1] "In the whole machinery of *springs* and *rivers*, and the apparatus "that is kept in action for their duration through the instrumentality of "a system of curiously constructed hills and valleys — we find such "undeniable proofs of a nicely balanced adaptation of means to ends, of "wise foresight and benevolent intention and infinite power, that he "must be blind indeed, who refuses to recognise in them the proofs "of the most exalted attributes of the Creator." — *Vindic. Geol.* p. 12, 13.

[2] See above, vol. i. p. 101, 2.

the *directions of the streams and rivers* which flow over the surface of the earth, from their sources to their mouths! These, are all so skilfully and so equally distributed over that whole surface, for the necessary service of the animal and vegetable creations; so artfully *diverted*, in many places, from the *nearest seas*, and conducted through *extensive inland regions*, as the Danube in Europe, the Ganges in Asia, the Nile in Africa, and the Amazon in America; that they disclose an irresistible evidence of *uniformity of plan and contrivance*. The *direction of all these rivers* is determined, in the first instance, by the *direction of the valleys* in which they commence their course; the first formation of those valleys must, therefore, in sound philosophy, be ascribed to the Designer and Artificer of the general system so manifestly intended for *irrigating the whole surface of the globe;* without which *system of irrigation*, the entire *system of vegetation* must necessarily have perished. If, then, the *vegetable system* is to be ascribed to the Divine intelligence; how much more philosophical and rational is it to admit, that the *correlative irrigating system*, to which the formation and direction of *valleys and river-beds* was as essentially necessary as the formation and direction of *arteries and veins* to the animal system, was a corresponding part of the same intelligent ordinance; than to suppose, that it was effected by the same mechanical *chance* by which rain trickles down a

footway, and that it was by *that chance alone* that the vegetable system, *created by intelligence*, was prevented from perishing through *a lack of providence!*

If, moreover, we examine the beds of rivers, we shall find, even where they consist entirely of *pebbles*, that they are covered with a *viscous* or *slimy* matter; by which *provision*, they are sheathed against that very action of the water to which the mineral geology would ascribe their original excavation. And we shall thus be certified; that the *artificer of the channels* was not the *subjected fluid*, but, that it was HE who has thus *protected the channels* against the erosive power of the fluid which HE has ordained to flow within them.

CHAPTER XI.

THE *formation of Coal*, is a problem which still engages the researches and speculations, not of the *mineral geology* only, but also of *pure Mineralogy and Chemistry;* and it will be found a subject of deep interest, both philosophical and historical, in the inquiry which we are now pursuing. M. D'Aubuisson, in the body of his "*Traité de* "*Géognosie,*" entertains a doubt, (which he afterwards determines for himself in his "*Table des* "*matières,*") whether this substance ought to be classed with *intermediary* or with *secondary* formations; to one or other of which, it has been variously referred by different mineralogists; and he therefore leaves the point, for the present, undecided. Upon the *nature and origin of coal*, he defers to the judgment of Mr. Hatchett; whom he duly designates "one of the most able che-"mists of our time, and who has applied himself, "more than any other, to the discovery of the "*origin of coal*[1]." That distinguished chemist, pronounces this question to be "a difficult pro-"blem in the natural history of minerals[2]." He states the different opinions which have been propounded, with respect to the *origin* of this substance; and he then declares his own.

[1] Tom. ii. p. 298, *notc.* [2] *Phil. Trans.* vol. xcvi. p. 135.

The different opinions which Mr. Hatchett states, are these *four*, of which the first *three* are *chemical* and *scientific:* the *fourth*, is altogether *speculative and imaginary*, and pertains exclusively to the *mineral geology*, viz.:

1. That *coal* is a *mineral* substance—an *earth*, chiefly argillaceous, impregnated with *bitumen.*

2. That it is a *vegetable* substance—consisting of *vegetable accumulations*, mineralised under vast strata of earth.

3. That it is an *animal* substance—consisting of the fat and unctuous matter of *marine animals.*

4. That it is derived from the *primeval Chaotic fluid.*

Mr. Hatchett declares his opinion to coincide with the *second* of these, and he establishes that opinion upon *experiments*, accurately made and repeated, in which he obtained *carbon* or *coal*, in large proportion, by the action of *sulphuric acid* upon *oak saw-dust;* which opinion, has been powerfully supported by the later skilful experiments and conclusions of Dr. Mac Culloch. Those experiments have determined the opinions of the best naturalists, both at home and abroad, to regard *coal* as a *mass of vegetable matter*, converted, by some natural process, into the substance which it now exhibits.

Notwithstanding, however, the success of those experiments, there was always *one deficit*

which rendered the coal *imperfect*. Mr. Hatchett could never obtain *bitumen* with his carbonated *oak saw-dust*[1], which substance is nevertheless an essential ingredient in *true coal;* and he therefore concluded, by entirely referring the production of the *bitumen* to *some unknown process of nature* in the transmutation of *wood*.

But, with all the deference which is so justly due to that eminent chemist, I must beg leave to suggest; that it would seem to be time enough to resort to that ultimate principle when all previous means of research shall have been exhausted, which does not yet appear to be the case. Experiments have, indeed, been skilfully made on *vegetable matter;* but, they have hitherto been made only on *terrestrial vegetable matter*. It seems to have been entirely forgotten in these investigations, that *terrestrial vegetation* is only *one part of universal vegetation;* and, that immense tracts of *marine vegetation* flourish in all parts of the *bed of the sea*. We may form a sufficient judgment, from the vast quantity of *fuci* and other marine plants vulgarly united under the denomination of *sea-weeds*, which are continually cast upon our coasts, and which are commonly used for *fuel* in the islands of Jersey and Guernsey, of the immense quantities of *these tribes of vegetation* that must be contained in the different basins

[1] Dr. Mac Culloch's able experiments, do not appear to have been attended with more positive and practical success in this particular. *Geol. Trans.* vol. ii.

and depths of the sea. That the great majority of naturalists, who inhabit the interior of the European continent, should overlook this vast portion of vegetation amidst the interminable forests with which they see themselves surrounded; would be less surprising, than that *we* should neglect to remark it, the foundations of whose soil are every where encompassed by it.

Now, since "all naturalists are agreed in this "one point, that our *present continents* were here-"tofore the *bed of the sea*[1];" since beds of coals are found to lie in "*concavities* varying greatly in "extent, from a few to many miles, and contain-"ing numerous strata of coal alternating with "*sand-stone, clay*, &c.[2]," which describes a formation analogous to an ancient *sea-bed*[3]; since *marine*

[1] See above, p. 45.

[2] BRANDE, *Manual of Chemistry*, vol. iii. p. 291.

[3] "Thin layers of sandstone, limestone, and gypsum, characterise, in "every zone, the *deposites of coal and of rock-salt* or *muriatiferous clay*." (Humboldt, *Sup. of Rocks*, p. 26.)—"It seems certain that the coal strata "were deposited within, and perhaps along, the borders of great accumu-"lations of *water*, whether *fresh* or *salt*; the *testacea* occurring in them "sufficiently prove this; and it is also certain, that in some periods of "the coal-formation (and more especially with regard to those beds of "coal which are occasionally associated with millstone-grit and lime-"stone shales) the water was *salt*, and that the evidence of its ever "having been otherwise is far from convincing. It hardly seems neces-"sary, therefore, to have recourse to a *series of reciprocating inundations* "*of the sea and fresh-water lakes*; but we may more naturally suppose "these deposites to have been *entirely formed within the former*, and their "disposition in *limited basins* seems further to indicate, that they were "accumulated in *friths or æstuaries*."—CONYBEARE, *Geol. of Eng.* Part I. p. 346.

substances are found in the *adjoining strata*[1]; and, since "numerous sea-shells, and even bones of "marine animals, are found in *imperfect coal*, as "in that of Pomiers in Dauphiny[2]," although none remain recognisable in *perfect coal*[3]; a strong argument of *probability* seems to arise, that, *if the substance of coal is of vegetable origin*, we are to seek for that *origin* in *marine vegetation* and not in *terrestrial*; that, the *beds of coals*, in their extensive *concavities*, were immense *accumulations of fuci*, &c., loaded with the various *animal substances*[4] that shelter among them, which were overwhelmed by

[1] DE LUC, *Lett. Géol.* p. 196. "Les *couches pierreuses* qui em-"brassent et environnent la *houille* renferment des *corps marins*." This assertion of De Luc has been questioned, and D'Aubuisson (tom. ii. p. 290) seems to regard it as equivocal; but Mr. Conybeare confirms it (Part I. p. 344, 5, and 351); and M. Humboldt observes, that "the "limestone of Kunzendorf with impressions of *fish*, and analogous to the "*bituminous marl* of Thuringia abounding also in *fish*, is entirely enve-"loped in the *coal sandstone*."—*Sup. of Rocks*, p. 42.

[2] D'AUBUISSON, tom. ii. p. 299.

[3] M. D'AUBUISSON subjoins the following note to his discussion *of Coal*, tom. ii. p. 294. "M. PROUST concludes, from his chemical ob-"servations *on coal*, that its matter pertained to *organised substances*; and, "after having remarked, that it yields a much greater quantity of *carbon* "and *bitumen* than our vegetables, he says; 'If *coal* is the result of or-'ganic productions similar to ours, its *imbedment* in the earth has not 'only annihilated every vestige of organisation, but has entirely dissolved 'and recomposed its elements, so as to convert them into these fossil 'masses.'"—*Journal de Physique*, tom. lxii.

[4] "This (says D'Aubuisson of the coal found in the marly hills at the "foot of the high mountains of Provence and Dauphiny,) is a case in "which we may admit with M. Héricart de Thuri, and other persons of "science, the *cooperation of animal substances* in the formation of *fossil* "*combustibles*."—Tom. ii. p. 379.

vast aggerations of the loose soils of the sea in the course of its retreat, and were left for *decomposition* and *recomposition* by the chemical action of the *marine fluid*[1] which they contained, and with which the *enclosing and compressing soils were saturated:* under which *compression* they had lain in course of bituminisation and mineralisation, for some thousands of years, before they were brought to light "*entirely dissolved and recomposed in their* "*elements, so as to be converted into the fossil masses* "*to which we give the name of coal.*" In *this class* of vegetation, *so circumstanced,* it is perhaps *possible,* that the ingredient might yet be found, which was uniformly wanting in the carbonisation of *wood of earthly growth.* At all events, there would seem to remain a higher probability, if *coal* be a *vegetable* substance, that such immense continuous masses of that substance *pertained to the sea-bed* in which they are found collected, than that they were casually transported thither from a distant continent; especially, since so vast a proportion of the *vegetable creation* as that peculiar to *the sea,* could not have been altogether anni-

[1] "There is reason to believe (says Mr. Hatchett,) that the agent "employed by nature in the formation of *coal* and *bitumen,* has been "*either muriatic or sulphuric* acid."—*Phil. Trans.* ib. p. 141. M. Humboldt describes "the limestone that covers *red sandstone with coal,* to be "an association of limestone, of *muriatiferous gypsum,* stinkstein, and "friable *bituminous marl:*" (p. 39.) and Mr. Conybeare states, that the coal formation is immediately covered by "*saliferous* sandstone." (p. 326.)

hilated, and remains to be accounted for[1]. Nor "may it be objected, that, if coal had really been "deposited in *the sea*, we ought to *find* fuci and "algæ among its vegetables; because, their ab- "sence from coal-strata is only a circumstance "common to this and every other formation, "though the great majority of them are *un-* "*doubtedly of sub-marine origin*[2]:" the succulent nature of marine vegetables rendering them an easy prey to "the chemical agents, which have entirely "decomposed them, so that no vestiges of them "remain[3]."

Of the vegetation of the bed of the primitive sea, we can form no idea from the matter of the coal itself, which has undergone an entire elementary transmutation; but, the adjoining strata

[1] Mr. Conybeare appears (*Geology*, &c., Part I. p. 328, 333,) to regard *peat*, *jet*, and *coal*, as different stages of the same transmutation; and he refers to Dr. Mac Culloch's excellent memoirs on this subject. M. D'Aubuisson is of a very contrary opinion, which he expresses with a decision that he rarely employs. "I shall not stop to examine the differ- "ent opinions that have been propounded on the *origin of coal;* I shall "only notice one, which is not without a specious appearance. It is by "some supposed, that the three great fossil combustibles, *coal*, *lignites*, "and *peat*, pass from one into the other by an effect of successive elabo- "ration, which is continually proceeding; so that, in the course of elabo- "ration, our *peat-beds* would become *coal-beds*. This idea could only "enter the mind of one who is ignorant, that nature has fixed in the "formation of these substances a line of demarcation which separates "them irrevocably." (Tom. ii. p. 301.) May not *lignites* have resulted from *terrestrial vegetation*, forests of the perished earth floated and sunk, during the great diluvial catastrophe, within those marine soils whose *native vegetation* is now transmuted into *coal*?

[2] CONYBEARE, *Geol.* p. 347. [3] D'AUBUISSON, tom. ii. p. 295.

preserve *imprints* of certain vegetable species, which, from their contiguity to the coal, may reasonably be assumed to be examples of some of those which have undergone the transmutation[1]. These, generally bear an appearance or configuration greatly resembling our present *reeds* and *ferns*; some seem to resemble *palm branches*. They have been commonly assumed to have been *fluviatile* or *marshy* plants; but, as they all differ from any which are now known, to pronounce them *fluviatile*, is to decide, without any evidence, a *question of fact*. Mr. Conybeare conceives "maritime or "semi-maritime plants[2]" to be constituent of peat. That the *coal vegetation* was *succulent*, may be inferred from the almost total absence of the appearance of ligneous matter[3]; and, the preservation of the palmated roots of some individuals, may testify that they subsist nearly in the place

[1] "When we see in coal-measures the vestiges of vegetables become "more numerous in proportion as we approach the beds of coal, it "is very difficult not to believe, that they were in a much greater quan- "tity in the beds themselves. If they are not found there, it is because "the chemical agents, acting upon the mass of vegetation, have entirely "decomposed them, so that no vestige remains: the *plants* were there, "but in their stead we now find *coal*; it is therefore natural to think, "that they have been transformed into that substance, especially as che- "mistry and observation attest the possibility of such transmutation." D'AUBUISSON, tom. ii. p. 295.

[2] *Geology*, &c. Part I. p. 327.

[3] CONYBEARE, ibid. p. 340.—"The accounts which have been given "of trunks of trees closely resembling peeled oaks, &c. discovered in our "coal-fields, must have originated in the hasty judgment of an eye unprac- "tised in examining these remains."—Ibid. p. 341.

where they grew. As we have found such strong ground for supposing that place to have been *a sea-bed*, we may, under all the circumstances of our *total ignorance* concerning their *primitive characters*, assume generally, that they were *vegetable productions of the primitive sea*, notwithstanding the similarity of their forms to some of our actual terrestrial vegetables; and, which have either ceased to exist, or which now exist only in depths of the ocean which we have not been able to scrutinise. Since several species, and even genera of animals, both marine and terrestrial, have ceased to exist from the time of the last great catastrophe, many marine vegetable forms may have also ceased to exist in the ocean, from the same epocha; and, the strong probability that *coal formations* subsist in an *ancient sea-bed*, tends more to establish that the plants which they contain were *marine*, than the unknown natures and equivocal characters of these, can establish that they were *fluviatile*.

And, this probability that coal was originally *marine vegetation*, may guide us to a final explanation of the *phenomena* which caused M. D'Aubuisson to entertain the doubt above mentioned; in the statement of which, he approximates so nearly to the Mosaical geology. "The *intermediary* class (he observes, with Wer-
" ner), pertains to an epocha, when a *revolution*
" *took place in nature, which, according to the evi-*
" *dence of the numerous indications which we see, was*

" *perhaps the* MOST VIOLENT *of those that happened* " *during the formation of the mineral crust of the* " *globe.* There is, indeed, great uncertainty in " fixing the *limits* between this class and those " which adjoin it; but, I think that they will be " assigned with sufficient exactness, if we say; " that the *intermediary class* is composed of the " *same rocks as the primitive,* but alternating with " some others containing relics of organic beings, " and a particular sandstone. We may, per- " haps, further say; that the *intermediary soils* " are those which succeed, in the order of time, " from *coal-beds* to the first appearance of *or-* " *ganised beings.* — I purposely avoid affirming, " in this definition, *whether or not the coal pertains* " *to the intermediary class*[1]; a point, on which " geologists *hesitate.*"

Thus, he abstained from deciding, whether the coal-deposit should be classed with the secondary formations, or, with the transition (*fragmentary*); and he left the question for a time, *sub judice.* Mr. Conybeare, on the other hand, takes a different course. In giving judgment on the question, he decides at once, that it belongs *neither to the one nor to the other*, but that it constitutes a *distinct Medial class* between the two; by relation to which, the classification of all the other formations ought to be regulated. He acknowledges, that " if he had been

[1] Tom. ii. p. 199, 200.

" obliged to refer the coal-formation either to the " *flætz* or to the *transition* class of Werner, he " should not have hesitated in preferring the " *latter alternative*[1];" and he assigns strong reasons for that preference: namely, 1. the greater conformity of the *coal-beds* to the inclinations, contorsions, and disturbances of the transition (or *fragmentary*) formation *beneath it*, than to the *horizontal* planes of the *flætz* formations *above it*: 2. the greater analogy of its chemical and external characters with the former, than with the latter: and, 3. the passage of its inferior surface into the fragmentary rock called *greywacke*, so that in many instances the limits between the two can only be arbitrarily assigned. And, thus it is, that M. D'Aubuisson afterwards decides, in his *Table des Matières* prefixed to his work: " The " *coal-formation* ought to be placed amongst *inter-* " *mediary* formations; it is its ultimate term: " such is my definitive opinion."

Yet, these several characters undeniably prove, that *coal* is the *earliest* of the formations resting on the *fragmentary base;* on which it immediately reposes, and into which it is very frequently incorporated. Mr. Conybeare states, " that it is interposed between the saliferous " sandstone and the older sandstone formations, " *or, where these are absent, resting on the transi-* " *tion rocks*[2]:" and M. Beaumier further states, " that in many places at Forez, *the coal is super-*

[1] *Geology*, &c. p. 323, 4. [2] Ibid. p. 326.

and which will have taken place, either during the long-continued *incumbency* of the primitive sea, or, in the violent and tumultuous agitations of its mass during the progress of its *departure:* for (says M. D'Aubuisson) "*coal* has been *produced* "in all epochas, both of intermediary and se- "condary formations[1];" that is, when the most ancient beds of marine vegetation were overwhelmed by the loose and moveable soils of the sea, on which fresh vegetation took place, until it was again overwhelmed in a similar manner; and this operation, in many instances, frequently repeated: which appears to "account for such "a surprising accumulation of vegetable matter "arranged in repeated strata separated from each "other by intervening deposits of *clay* and *sand*[2];" and to account also for the faults or failures in the desiccated strata of those deposits, resting on a material diminishing in bulk.

Thus, then, the *phenomena of coal,* viewed by the light of the Mosaical geology, both illustrate and receive illustration from, our general argument, that *the surface of our present earth was never extricated from the primeval ocean until the last or diluvial revolution, which first exposed it by the transfusion of the waters into a deeper receptacle;* and, thus we are brought to render more precise and specific the general description of coal which was proposed in the first instance; and to sug-

[1] Tom. ii. p. 377. [2] CONYBEARE, *Geol. of Engl.* p. 345, 6.

gest, with augmented probability—that *coal* is a *vegetable substance*, consisting of *marine vegetation* bituminised and mineralised, in its native bed, under vast accumulations of different marine masses which composed the moveable soils of the primitive sea.

It would be gratifying to learn, that the eminent chemist who first applied his mind with any success to this inquiry, or his able and distinguished friend the author of the "*Manual of Chemistry*," or the cautious and dispassionate philosopher who has prosecuted the inquiry with such admirable sagacity, has been disposed to lend the benefit of his skill and science to the *examination*, at least, of the subject, which is here, with great deference, suggested for their consideration.

CHAPTER XII.

I SHALL now beg leave, in my turn, to propose a problem to the mineral geology relative to its assumption, that *the revolution* which occasioned the destruction of the animal races of which we discover fossil *exuviæ*, was *different from* and *prior to*, that which established the progenitors of the present human race in Asia; and I shall propose my problem in the words of a writer, of whom the mineral geology can entertain no mistrust as writing under too strong an influence of the Mosaical geology.

"The *Camel*," says Buffon, "is more completely a slave than any other of the domestic animals; because, in all the other species, such as the *horse*, the *dog*, the *ox*, the *sheep*, the *swine*, &c. we find some individuals in a *state of nature;* animals of the same species which are *wild*, and which man has never brought under his subjection. Whereas, *in camels, the entire species is enslaved; it is no where found in its primitive state of independence and liberty*[1]." Now, the *domesticity of an entire race of animals*, is assuredly a phenomenon as well worthy of investigation, as the *extinction of an entire race;*

[1] *Hist. Nat. du Chameau*, tom. iv. p. 338, 4to.

and it must have a *cause* equally specific and distinct.

This general assertion of Buffon, however, requires to be qualified, and to be reduced to its exact measure of *truth*. It is *true* only of the *Arabian camel*, or the camel with *one hunch*; for, of the *Bactrian camel*, with *two hunches*, we know that the race now exists in a wild state in Tartary[1], (where was the ancient *Bactria*,) and in the north of China. "Both the *wild* and *tame* "camels," says Duhalde, "are found in the "countries which border upon the north side of "China; at present, the *wild* ones are only to "be met with in the country which lies north-"east of China. Chi Tchin gives the following "account of this animal. 'The *camel* has very 'much the resemblance of a horse in its body, 'and has a head like a sheep; it has a long neck, 'and ears that hang down; it has three joints to 'its legs, and *two bunches of flesh on its back which* '*form, as it were, a kind of saddle*[2].'" This is the *Bactrian camel*. Of the *Arabian camel*, the assertion of Buffon remains *true*, in all its extent; this animal *alone* exists not in a wild state, but *only in a state of domesticity*. Cuvier has inadvertently affirmed, that "the *dog* is the animal which man

[1] *Nouveau Dict. d'Hist. Nat.* art. CHAMEAU.

[2] *History of China*, vol. iv. p. 33, 8vo.—"Le chameau à *deux bosses* "subsiste sauvage dans les grands déserts entre le Tybet et la Chine." —PALLAS, *Observ. sur les Mont.* p. 15, note.

" has reduced *most completely* under subjection[1]." We know that this is not the case, for the *dog* is found in a wild state; but, the *Arabian camel exists no where in a wild state.* This singular and mysterious animal, from the earliest periods of Asiatic history, has constituted a principal part of the wealth of the regions in which it is possessed. Buffon's ridiculous conceit, that the Bactrian camel had originally *but one hunch*, and that it acquired its *two hunches* from the condition of *servitude* to which the race has been subjected, is exposed by two simple facts; 1. That the *only* species of camel which exists in a *free* or *native* state, is that with *two hunches;* which alone could endure the climates of the high latitudes in which it is found in that state. 2. That the *continuance in servitude* of the Arabian camel, has never discovered any tendency to produce such an alteration in its conformation. This idle hypothetical whim of Buffon, is rejected by all the best and latest naturalists[2].

That the *Arabian camel* does not exist in a state of *nature*, but only in a state of *domesticity*, is a fact thoroughly ascertained. Nor can it be suggested, that it may hereafter be discovered in a natural state; for, the remark of Cuvier, concerning a research for the *extinct species*, is equally applicable to that of this species of camel *in a*

[1] *Theory of the Earth*, § 30.

[2] *Nouveau Dict. d'Hist. Nat.* art. CHAMEAU.

state of nature. "If there still remained any "great continent to be discovered," says he, "we might yet expect to find them; but it is "sufficient merely to glance the eye over a map "of the world, and to observe the innumerable "directions in which navigators have traversed "the ocean, to be satisfied that there cannot be "any large tract of land to be discovered, unless "it may be situated toward the Austral or "Antarctic pole, where the ice would not allow "the subsistence of animal life[1]." Throughout the entire globe, now so well known to us, *this camel exists only as a property of man.*

Now, to *what cause* are we to attribute this most extraordinary fact? There are but *two* causes imaginable, in the nature of things: either, that the entire race, after having spread itself, like all other brute races, in free range over the globe, had at some period been chased, collected, caught, and secured by the confederated efforts of mankind; and so successfully, that *not a single pair* escaped in any of the solitudes of the earth to reproduce a free race: or, that at some period, the whole of that race was, *by some cause to be assigned,* reduced and placed within the power of man, *from which it never afterwards escaped.*

The *first* of these cases, every sound understanding will discern to be morally impossible. We might as well account for the extinction of

[1] *Disc. Prél.* p. 31.—*Theory,* § 25.

the race of the *mastodon*, by a similar confederacy; which the wildest speculator has never yet imagined. The *last case*, therefore, can alone be *true*. But, what *cause* can *physics* assign, for the reduction of this race of camels, at any period or *epocha of nature*, so entirely within the power of man, that it never again acquired its original freedom? Is it not amazing, that a naturalist of pre-eminent celebrity, who has been designated, by excellence, *the Historian of Nature*, and whom physical adulation has even entitled "*majestati* "*Naturæ par ingenium*;" is it not amazing, that he should have stated thus forcibly so extraordinary a *fact of his own science*, and yet should not have given himself the concern even to make an attempt to assign its cause?

But, the *Mosaical record* enables *a child* to assign the cause; for it relates, that *this race of camels perished, with all other animals, in the catastrophe of the deluge, excepting only* ONE PAIR[1] *reserved* "*to keep seed alive upon the earth*;" *and that thus, the entire race, diminished in number to* TWO INDIVIDUALS, *became actually reduced and placed within the power of man.* And, when their possessors, quitting the ark, commenced their new establishment in *Asia*, these valuable animals, formed to render such important services in those regions, were carefully *preserved* as they increased and multiplied with the generations of mankind,

[1] The *camel* (Levit. xi. 4) was classed among the *unclean* beasts; of which, God instructed Noah to take only "*two, the male and his female*."

and were never suffered *to escape from domesticity* like individuals of every other species; and therefore, *they* ALONE *never recovered their primitive state of independence and liberty.* Hence, they were always accounted *a race pertaining to Arabia*[1]; in which region they have been transmitted in a direct line, from the patriarch who introduced them, as a *reserved property* of one branch of his descendants. And, the same care that prevented their escape to freedom in the first age of the renovated globe, is still notoriously exercised in their preservation. It is equally notorious, that the *Arabs,* to this day, hold their *camel* in peculiar veneration, accounting it *a sacred animal, a gift of God to man*[2]; the origin of which *traditionary sentiment,* may reasonably be referred to the *origin of this postdiluvian* race.

Thus, then, a *cause* is incidentally found *in the record,* which perfectly explains, and which alone can explain, an *animal phenomenon,* as mysterious to natural history as the existence of the *misletoe* in vegetation; but, which the professed *Historian of Nature* had not either the skill to detect, or the frankness to avow. And, what was it that so warped his mind as to make him either overlook or withhold this obvious cause? his *geological*

[1] ἀι καμηλοι αμφοτεραι, ἀι Βακτριαναι, και ἀι Αραβιαι.—ARISTOT. *Hist. Animal.* lib. ii. cap. 1. "*Camelos* inter armenta pascit Oriens, *Bac-*" *triæ* et *Arabiæ.*"—PLIN. *Nat. Hist.* lib. viii. cap. 26. Hardouin.

[2] "Les Arabes regardent le Chameau comme un présent du ciel, un " animal sacré."—BUFFON, *Hist. Nat. du Chameau.*

prepossessions: for, how should the framer and propounder of a *theory* which maintained, that this earth was originally a lump of matter knocked off from the body of the sun, by some rude and awkward *comet* which struck against it in the eccentricity of its orbit, resort for the cause of the *domesticity of an entire race of animals* to the authority of *a record, which contradicts and exposes his false and lunatic theory?*

It may be advisable, to notice here a very material error in a work professedly designed for the instruction of youth in natural history. In that work, treating of the Arabian camel, the author states: "the *Arabian camel* is chiefly "found in a *wild state* in the deserts of *Arabia* "and *Africa*, and in the *temperate parts of* "*Asia*. It is that with a *single hunch* on its back. "In many parts of the East it is *domesticated*[1]." The whole of this statement, is in direct contradiction to the *fact*. The author omits all mention of the Bactrian camel, with *two hunches*, which *alone* exists in a wild state; and that, in no other part of the globe but in Chinese Tartary, and the regions contiguous to it. But, the *Arabian camel exists not in a wild state*, either in *Asia* or in *Africa*; and, the individuals of that species are *not domesticated*, but the entire race is *born domestic*. By this statement therefore, which manifests a negligent confusion of the two species, this im-

[1] *Animal Biography*, vol. ii. p. 2.

portant fact of natural history is corrupted, and a most instructive *truth* is excluded from the knowledge of the juvenile reader.

The translator of *Norden's Travels* has fallen into a ridiculous mistake, which also may here be rectified. He thus renders his author: "We "saw that day (on the Nile) *abundance of camels;* "but they did not come near enough for us "to *shoot them.*" And he adds in a note: "In "the original it is *chameaux d'eau* (*water-camels*); "whether they are a *particular species of camel,* "or a *different kind of animal,* I do not know[1]." This *chameau d'eau* or *de la rivière,* the *Gemel el Bahr* of the Arabians, is no other than *the pelican,* of which Buffon gives this notice; "the Egyptians "have denominated this *great bird* the *river-* "*camel,* in allusion to the manner in which it "*retains the water in its pouch*[2]."

The *domesticity* of the entire race of this peculiar species of camel, is therefore a living and perpetual evidence, both of *the revolution* in which the whole animal creation perished excepting a *reserved few,* and of *that* also in which the human race was first established on the *continent of Asia;* and it is therefore evidence, that those revolutions, supposed by the mineral geology to be *different and distinct,* were, in fact and truth, *one and the same.* Bishop Watson remarked, that he never saw *a Jew* but he beheld in him *a living testimony*

[1] Page 11, fol. [2] *Hist. Nat. des Oiseaux,* tom. viii. p. 296, 4to.

of the *truth* of the *Old Testament;* in the same manner, we never see *a camel of this species,* but we may behold in it a *living testimony* of the *truth* and *unity* of the revolution, which both *loaded the soils of northern Europe with animal fragments from the perished earth, and fixed the progenitors of the present race of mankind in the western regions of Asia.*

CHAPTER XIII.

How far the CREATIVE POWER was exercised upon the *new earth*, is a point on which we are not expressly informed; although we are left to deduce the *assurance of its exercise*, with respect to *vegetation*. Where we cannot look for operation in *secondary* causes, we must necessarily resort to the first principle of universal physics, *the intelligence and power of God*. The vegetation which invested the mineral surface rendered dry by the *second revolution*, cannot be philosophically ascribed to *any other cause*, than that which invested with vegetation the mineral surface rendered dry by the *first revolution*: this is an induction, which reason does not merely *allow*, but positively *demand*. It is saying nothing, to say with the mineral geology, "*after the deluge, vegetation "quickly ensued*[1]." *How* did it *ensue?* Had the *same terrestrial surface* remained, vegetation could not have *ensued* by virtue of any law of what we term *nature;* for, the universal lodgment of the sea upon it for nearly *ten months*, must, by those laws, have extinguished every principle of germinating life. But, it was *not* the same, but another, a *new, brute, marine surface,*

[1] KIRWAN, *Geol. Essays*, p. 98.

in which the *seeds of terrestrial vegetation had never been sown.* It must, therefore, have been called into vegetation, by the same *creative word* which called into vegetation the surface of the *former* earth when it was first extricated from the waters of *the abyss.* When it is said, "a "general flood *tore up* the solid strata of the "earth, and reduced the *surface to a state of* "*ruin*" — and when it is added — "but this "disorder was of short duration; animals and "plants, similar to those which had perished, "*once more adorned its surface,* and *Nature again* "*submitted* to that regular system of laws which "has continued uninterrupted to the present "day[1];" — nothing, in fact, is said to satisfy the requisitions of *reason,* and therefore, nothing that should satisfy those of *science.* For, if the former vegetating surface and its solid substrata were "*torn up and reduced to a state of ruin,*" the *reparation of the ruin* and the *adornment of the new surface,* must have been effected by a *new and adequate cause* irreferrible to any *secondary agencies;* and, the omission of that *cause,* and the equivocal allegation of *Nature*[2], is not more disappointing to *religion* than it is to *true philosophy.*

Again; we are told, that the summits of the highest mountains did not appear above the aqueous surface until the first day of the *tenth* month, from which level the waters descended

[1] GREENOUGH, *Geology*, p. 194. [2] See above, vol. i. p. 105, note.

gradually for *forty-seven days;* and yet, *seven days* after their final departure "from off the face of "the ground," we find, in this *marine soil*, an *olive tree in full foliage*[1]. This vegetable production therefore, cannot, with any assent of reason, be referred to any other cause than the same divine *fiat* which at first commanded — "*Let the "earth bring forth the* TREE *yielding fruit;*" and which, long afterwards, caused "*a gourd to come "up in a night*" and to form a shelter impervious to the ardor of an Assyrian sun[2].

With respect to the *animal* creation, we are equally left without any positive information; yet, the *monumental evidences* of animal genera *withdrawn from the earth* in that revolution, establish a strong argument of *probability*, that *other genera were created to supply their place in the sphere of animal life;* a *probability*, which cannot be disputed, with any *consistency*, by those who maintain, "that the differences of organic remains *seem to "indicate, that* NEW RACES *of organised beings have "* SUCCESSIVELY ARISEN *and become extinct*[3]," because, it is most certain, that *not one of those "new "races" could have "arisen," otherwise than by an immediate exercise of the Creative Act*[4]. All those writers therefore, plainly, though indirectly, propound an *indefinite plurality of creations;* unless, indeed, any of them are prepared to assert, that *new races can arise without creation.* And, this brings

[1] Gen. viii. [2] Jonah, iv. [3] BUCKLAND, *Vind. Geol.* p. 30, and *note.*

[4] See this proposition ably argued by Mr. Pr. Buckland; above, vol. i. p. 66.

us to the consideration of a question which has been raised, not upon a *speculative* but a *critical* ground, respecting *the portion of the animal creation contained in the ark.*

The ground of the question, is this. The record relates, that God thus commanded Noah: "*Of every living thing of all flesh,* pairs of every "sort shalt thou bring into the ark, to keep them "alive with thee." Now, it has been urged; that, although the *terms* of this command are *universal* (*every living thing*), yet the scriptural style so often employs *universal terms* with *limited significations,* that the universality of the *terms* will not necessarily prove that an *universal sense* was intended, unless that sense be otherwise *circumstantially fixed.* And, this is undeniably true, in very many instances; upon which account, Dr. Hammond, in his note on 1 Cor. xiii., has been led to remark: "the word παντα — *all* "*things,* though it be an *universal,* is not to be "taken in the *utmost extent;* but, according to "the use in like phrases in all languages, wherein "the *universal sign* affixed, either to *persons,* "or *times,* or *places,* or *things,* signifies only a "*greater number,* but not *all* without exception." Schleusner likewise observes: "that the word "πας—*all, every,* is often employed in Scripture, "*indefinitely,* to signify *various, of different kinds;* "and often also, to denote *many, a great number*[1]."

[1] *Lex. Gr. in N. Test.* Conf. ARISTOT. *Poetic.* cap. 25. το γας ΠΑΝΤΕΣ αντι του ΠΟΛΛΟΙ κατα μεταφοραν ειρηται — "ALL, *is said* 'metaphorically for MANY."

When our Lord said, "*all things which* (παντα ἁ) "I have heard of My Father, I have made known "unto you[1];" it is evident, that the term is not to be understood universally and absolutely, but restrictively, and with relation to a *special object*. Michaelis remarks to the same purpose: "The "Jews have well observed, that כל, *all, every*, "is not to be understood, on all occasions, with "the mathematical sense of *all;* because, it is "also used to signify *many*. Thus in Isaiah, "xxiv. 10, where we read, '*every house is shut* '*up*,' Kimchi most truly observes: 'though he 'says, *every house*, he only means *many;* as it is 'said, '*all countries came into Egypt*.' I quote "the judgment of a *Jew* rather than of a *Chris-* "*tian*, that I may not be mistrusted; but, if we "reflect upon our own native tongues, we shall "find, that we often use the term *all*, for *many*, "or *most*[2]." Josephus renders the Hebrew by παντοιος, which signifies, both *omnigenus* — of *all kinds*, and *multiplex* — of *many different kinds*.

It is thus, that in the vision of St. Peter, in which it is related by the *historian*, that he beheld a large vessel containing παντα τα τετραποδα της γης[3] — "*all* the four-footed beasts of the "earth," &c. it is not necessary to suppose that they were, zoologically and numerically, *all the quadrupeds of the creation;* but, only a number and a variety sufficiently great, first, for the

[1] John, xv. 15. [2] *Suppl. ad Lex. Heb.* no. 1158. [3] Acts, x. 12.

selection which Peter was called upon to make between *clean* and *unclean;* and next, to prove to him how extensively those distinctions were now done away by God. Accordingly, that passage is rendered by Schleusner, "*varii generis qua-*" *drupedes—quadrupeds of various kinds;*" and it is paraphrased by Pyle, "*abundance of beasts.*" And with good reason; for, where *St. Peter himself* afterwards relates the vision to the apostles, he omits the word παντα — "*all,*" and says only, τα τετραποδα[1] — "*four-footed beasts.*" We have a remarkable example of this strong mode of speech in 1 Kings, xviii. 10; where Obadiah affirms thus forcibly and solemnly to Elijah: "as the Lord "thy God liveth, there is *no nation or kingdom* "whither my Lord hath not sent to seek thee[2]:" which affirmation, though universal in its *terms,* was evidently not designed to be universal in its *signification;* and, innumerable instances of the same mode of speech occur in the sacred writings. In the same manner, it is alleged, we are to understand *with limitation* the terms of the record in the passage which we are considering; there being nothing in the history to controvert such an interpretation, which other considerations tend to render probable, namely, the correspondence between the dimensions which are given of the capacity of the ark, and our present extended knowledge of the varieties of the animal creation.

[1] Acts, xi. 6. [2] 1 Kings, xviii. 10.

For, the relative calculations of numbers and capacity exhibited by Prideaux, Pole, and some pious foreign divines of a former age, are more ingenious than they are truly available.

There is nothing in this acceptation of the history, which is not perfectly consistent with the text; considering, that the context contains nothing to *define and fix the signification* in the particular instance which we are considering: for, the words "*all flesh,*" are here only comprehensive of the distinctions "*clean* "*and unclean,*" expressed in the succeeding chapter. And, the force of this critical argument will be more sensibly apparent, if we consider with attention the declared object and design of the command; which does not convey an injunction to preserve *specimens* of every species, but, to *select pairs* of such as should be preserved, in order to *keep their races alive.* If we observe the *construction* of the sentence, we shall perceive, that it is idiomatically *inverted* from the order of the *import,* which is this: "and thou shalt bring "into the ark *pairs* male and female, of every "living thing of all flesh, *to keep them alive with* "*thee.*" Here, "*of every living thing*"—παντων, is strictly amenable, according to the practice of the language above exposed, to the relative interpretation—"of every living thing (which thou shalt "bring into the ark) thou shalt bring in *pairs to* "*keep them alive.*" This is the *direct and final object* of the mandate. And, if such is its sense, that

only a *numerous selected portion* of the animal species was preserved in the ark; then it would seem, that the divine purpose in that *partial preservation* was, first, the preservation of the progenitors of a new human race; secondly, the preservation of a number of animal species sufficiently great to provide an *impressive memorial*, of the faith of Noah and of the fact of that fearful catastrophe, to be transmitted circumstantially by tradition to succeeding generations; and thus, to constitute τυπον, a *type* of divine deliverance, of which St. Peter has pointed out αντιτυπον, an *antitype*[1]. For, it is most certain that we are not to understand, *that God could not have had animals to inhabit His earth, unless He had taken a provident care of those which He then had alive.*

But, this determination of the question gives immediate rise to another question, viz. *from whence*, then, proceeded all those *other species* of animals now existing upon the earth, of which *none* were contained in the ark? Hypothesis, and system, are at once ready with their answers. But, before we admit of any answer, we must lay down *two* indispensable conditions, to which that answer must submit; 1. It must *not contradict the history:* 2. It must be *in consistency and harmony with the history.* Every judgment exercised to reasoning, will admit the justness of these two preliminary conditions. And these being ad-

[1] 1 Peter, iii. 21.

mitted, we can by no means allow the explanation proposed by De Luc; that those species subsisted, during the deluge, upon certain *islands in the ancient sea*, which, as the sea retired, became the *summits of mountains on the new continents*. 1. Because this explanation, however ingenious it may appear, is plainly a mere shift and contrivance of the *invention*, which betrays its fallacy on a moment's reflection; for, as Mr. Kirwan has justly observed, "if such islands did exist during "the deluge, it would surely have been more "convenient for Noah, his family, and animals, "to have been transported at once to one of "these, than to have remained pent up in the "ark," for upwards of twelve months. But, 2. and principally, because it is so far from being *in harmony* with the history, that it directly *contradicts* it. For, the history expressly declares, that "*every living substance* was destroyed, except "Noah, and those which were with him in the "ark." And, the words "*every living substance*," cannot be taken here with *limitation*, as in the former passage, although the younger Rosenmuller would so interpret them[1]; because, the

[1] This learned annotator, seduced by the same pretensions of the mineral geology which had seduced his learned father, uncritically contends; that the proposition, "ALL *the high hills and mountains* UNDER "THE WHOLE HEAVEN *were covered*," is not to be understood universally, because we find the phrase, "UNDER THE WHOLE HEAVEN," used with limitation in Deut. ii. 25.—(*Schol. in Gen.* vi. 24, p. 64, 5.) But, how it is used there? "*This day will I begin to put the dread of thee*, "*and the fear of thee, upon* THE NATIONS UNDER THE WHOLE HEAVEN

universality of their signification is *fixed* by another passage, which distinctly states, that the waters were elevated, for some months, *fifteen cubits above the summits of the highest mountains;* so that every part of the earth on which animals might have continued to exist, was necessarily submerged. So Josephus reasons: "The waters "were elevated fifteen cubits above the earth; "and this was the cause why more were not "saved, that they had no opportunity of escape[1]." If, therefore, we are to understand from the record, that *only a selection of animal species was preserved in the ark:* we must necessarily understand also, that *all the remaining species perished in the waters*[2].

"WHICH SHALL HEAR OF THEE," &c. Here, the universal term "ALL" is exchanged for the *express limitation*, "WHICH SHALL HEAR OF THEE;" and these are specified in Exod. xv. 14, 15, to be exclusively the inhabitants of Palestine, Edom, Moab, and Canaan.

[1] *Antiq. Jud.* lib. i. p. 15.

[2] The *Edinburgh Reviewer* of the *Reliquiæ Diluvianæ* says, that "after "having given the most attentive consideration to the text, he cannot "perceive *any thing* that should render the *wider interpretation* more "allowable in *one* of the cases, than in the *other*." With so fair and acute a critic, it is always satisfactory to be engaged. Let us consider, then, the *terms*, in the two cases. In the one case we are told, that "*all* "the high hills, and mountains, that were *under the whole heaven*, were "covered by the waters." Here, the interpretation of the word *all*, is at once determined by the *nature of the fact declared*. If Ararat, or Chimboraço, was *below the aqueous surface*, so necessarily, by the *law of fluids*, were *all* mountains of the same elevation "*under the whole heaven*." But, "when it is said, of *every* living thing of all flesh (i. e. clean and unclean) "two of every sort (i. e. of each sort) thou shalt bring into the ark;" no such *necessary* determination of the interpretation of the word *every*, is produced; and it would be unskilful and unlearned to determine the interpretation without considering the *power of the term*, the general *practice* of its inter-

But now it will be asked; *from whence, then, proceeded the first of all the species actually existing, of which there were none in the ark?* I ask, in reply, *from whence proceeded the first of all the species actually existing, of which there were some in the ark?* The solution of the *latter* question, will be the solution of the *former*. The *Renovation* of the earth, and its *Creation*, are events which bear so direct and true an analogy to each other, that reason directs us to conclude of the one from the other; and, in defect of knowledge concerning the one, to deduce it from our knowledge respecting the other. *Vegetation*, in the new earth, must have been a *new creation;* and, why should not *new creation* have extended, in the *new earth*, to the *animal* as well as to the *vegetable* kingdom, if it was the intention of the Creator that the ark *should not contain individuals of every species?* That such was His intention, is proved by the multitude of fossil remains of animal species and genera which *no longer exist;* that it was His intention, that the ark *should contain some*, is proved, both by the terms of the record, and by the extraordinary and irrefragable evidence of the *Camel of Arabia*. In

pretation, and the circumstance to which it is *here applied*. And, since its native power is *various*, since it is *variously employed* in practice, and since its restricted interpretation of πανταχοῦ, as given by Josephus, is applicable in *this case*, but not in *the other case;* the Reviewer might, without much difficulty, "perceive *something*, that should render the "wider interpretation more allowable in *one* of the cases, than in the "*other*;" and I have given abundant examples, of the power and practice of the term.

understanding the historian to relate, that only a limited number of species were preserved, and that all the rest perished; and in inferring, as a necessary consequence, that the Creator replenished His new earth with *new species*, by His own divine act, after He had brought it to light; we do *not contradict* the history, which is altogether *silent* upon the subject, and we interpret *consistently* with the history, because we interpret in conformity with its declarations in *a case analogous*. There is no other difficulty whatever in this solution, than that which *mere physical science* has always to encounter, in admitting *immediate creation* as the *true* MODE *of all first formations;* and which urges it to interpose as many imaginary causes as it can devise between *all effects* and a *first cause*, even where no secondary cause can possibly have intervened. It has thought fit to assume, gratuitously, that it is *unphilosophical* to argue, in *physics*, beyond *secondary causes;* that we are bound to find the causes of *all sensible phenomena* among *secondary causes;* and, that the mention of *creation* is not to be admitted in *physics*. This was the *great principle* which the materialism and infidelity of the two last centuries laboured so industriously to establish, in order to exclude all *moral interference*, and which *physical science* so generally and so absurdly conceded; with the vast exceptions, however, of BACON and NEWTON. But, in so doing, it only proved itself to be "*unphilosophical;*" and

rendered itself incapable of reasoning to "*the most* "*general principle.*"

Τι απιστον κριναται παρ' ὑμιν[1]—"*Why should it be* "*thought a thing incredible with us,*" that God, who created once, should have created more than once? Is it, that the creative act could be exercised *only once,* and therefore, that His *creative power was exhausted* in its first effort? Is it, that we are in possession of *the rule* by which alone creative power may be exercised? Or is it, that we are any where *told* that God has *never* exercised that power since the first *universal creation?* When He pronounced the *fiat,* "Let "the river *bring forth frogs abundantly*[2]," &c.; it was assuredly the same *fiat* with which He had at first pronounced, "Let the waters *bring* "*forth abundantly the living creature that hath* "*life.*" The philosophers and naturalists of Egypt, nay, Moses himself, *concluded,* that that innumerable swarm "which covered the land, "and filled the villages, and houses, and fields," must have been the *natural inhabitants* of the Nile; and they therefore prayed, "that they "might depart, and *remain in the river only*[3]." But, when their prayer was heard, those animals were not caused to depart and to *remain in the river,* of which they were *not the natural inhabitants;* for, being only designed as *a temporary burthen on creation,* "the Lord did, indeed, ac-

[1] Acts, xxvi. 8. [2] Exod. viii. 3. [3] Exod. viii. 9—11.

" cording to the word of Moses, *but the frogs died,* " *and they gathered them into heaps*[1]." De Luc, perhaps, would have "*easily conceived,* how this pro- " duction might have been contrived; not indeed " *without a miracle,* but *without a new creation*[2]." But, this is a capricious and irrational distinction; for, *if it was by miracle,* it is as probable, that that miracle was exercised in *new creation,* as in any other *supernatural mode:* there can be no *natural rule* for judging of *supernatural action.* It is just as easy to an unsophisticated intelligence to deduce *primitive formation* from *creative power,* as to deduce *secondary formation* from *generative power.* It is certain, that, *if it was by miracle,* we are utterly impotent to determine of ourselves, *what particular mode it was.* All *physical probabilities,* are here absolutely *vain* and *impertinent.*

To determine to refer *every effect* to a *secondary cause,* in a crisis in which the *First Cause* was in immediate and manifest operation, is, setting aside all moral considerations, most unskilful and irrational; and demonstrates an entire alienation from the philosophy of Newton, of which the great principle is, " *de* DEO *ex phænomenis dis-* " *serere, ad philosophiam naturalem pertinet—It* " *pertains to natural philosophy, to reason from* " *phenomena to* GOD." Now, the *phenomena* which we are considering, necessarily *lead us to God.*

In the case of the *human race,* it was essential

[1] Exod. viii. 14.

[2] See above, vol. i. p. 244, note.

to the *moral purpose* of God that the *whole race should descend from one and the same first parent;* because, His mysterious scheme for their *ultimate destination* was founded upon their *common relation to that first parent:* "IN ADAM, ALL DIE[1]." Therefore, "*He made of the blood of one and the* "*same man*[2]*, all nations of men*" (for, so the passage should be rendered). But, since that *moral purpose* did not include the *brute races*, we have *no reason whatever* for supposing, that it was indispensably necessary that *every postdiluvian brute race* should descend from an *antediluvian parent;* and, *physics* cannot pretend to assign any law which can *prescribe bounds* to the creative power of Him, Who "*killeth and maketh alive*[3]*, and Who* "*will do all His pleasure*[4]."

I conclude, therefore, 1. from *the record of the deluge*, that the *whole animal creation*, excepting only that selected portion of individuals which was preserved in the ark, *perished in that catastrophe.* I conclude, 2. from the *innumerable fragments of extinct species which remain*, that individuals of *all* the antediluvian animal species were *not preserved in the ark.* And, if there is reason to infer, either from the *genius of the historian's language*, or from the *dimensions of the ark* which he has so carefully

[1] 1 Cor. xv. 22.

[2] Acts, xvii. 26. ἐξ ἑνος αἱματος, i. e. ἐξ αἱματος ἑνος (sub. ἀνθρωπου): ἑνος, is here in regimen to αἱματος, not to ἐξ: as in Rom. v. 18. δι' ἑνος παραπτωματος, is, δια παραπτωματος ἑνος (ἀνθρωπου.)

[3] 1 Sam. ii. 6.

[4] Isaiah, xlvi. 10.

and minutely imparted to us, that he does not affirm that *individuals of all the postdiluvian species were contained within that fabric*, I then conclude, 3. and finally; — *that he has left us to infer, from his history of the* CREATION, *that the same Almighty Being whose operations he has therein recorded, exercised His* CREATIVE POWER *in animal no less than in vegetable formations, in the* RENOVATION *of His globe; that "He took away their breath, and "they died, and returned to their dust; that He "sent forth His Spirit, and they were* CREATED, *"and He* RENEWED THE FACE OF THE EARTH[1]."

It is *manifest*, from the *exuviæ of the extinct genera and species*, that the ark *excluded many varieties of animals*: this is a *conclusion from the phenomena*, infinitely more *sound* than any which the speculations of the *Mineral Geology* have been able to extort from them. It is therefore *probable*, that the animals assembled for preservation were collected from only *a part* of the primitive continents, namely, that part in which the patriarch himself resided; and it will then become *further probable*, that a *new animal creation*, of various species, followed the production and desiccation of the *Second Earth*, as the same had followed the production and desiccation of the *First Earth*. And, such *must have been the case*, if it was the intention of the Designer and Disposer of this globe so to distribute the *habitable surfaces* of His

[1] Psalm civ. 29, 30.

new earth, by the *interposition of waters*, that the brute races which He formed to inhabit them *could not*, like the human race, *pass from the one surface to the other by the laws which He assigned to their natures*. And accordingly, *the* CHARACTERISTIC PECULIARITIES *which have been so remarkably and admirably provided to distinguish from each other the animal species of the different continents, testify irrefragably in establishment of* THAT FACT. "The "great continents, as Asia, Africa, the two "Americas, and New Holland (says Cuvier,) "contain large quadrupeds, and, in general, of "*species peculiar to each of them*; so that when "any of those lands were discovered which "had been *insulated by their situation from the* "*rest of the world*, a class of quadrupeds was "found, *entirely different from any which existed* "*elsewhere*. Thus, when the Spaniards first "spread themselves over South America, they "did not find there a single quadruped like "those of Europe, of Asia, or of Africa. The "*puma*, the *jaguar*, the *tapir*, the *cabrai* or *capy-*"*bara*, the *lama*, the *vicugna*, and the *sapajou*, "were animals entirely new to them, and of "which they had no idea. The same phe-"nomenon has been renewed in our days, when "the coasts of New Holland and the adjacent "islands were explored. The different *kangu-*"*roos*, the *phascoloma*, the *dasyurus*, the *paramela*, "the flying *phalangers*, the *ornithorinchus*, the "*echidna*, came to *astonish Naturalists by strange*

" *conformations, which broke through all rules and* " *rebelled against all systems*[1]." We may presume, that the *rules* thus violated, and the *systems* thus undutifully treated, were those of the *Naturalists*, not those of the *Creator*; so that, though the *mineral geology* may participate in their astonishment, the *Mosaical geology* can take no share in it, at least, not upon the same grounds.

The *Creation* and *Renovation* of the earth, were coordinate events, corresponding by various and true *analogies*; and they are both to be referred to the same Intelligence, and to the same Power. Whether we consider them, with relation to the *production of an habitable land by the removal of the waters which covered it*, or, to the *clothing that land with universal vegetation*, or, to the *commencement of new human and brute races to inhabit and possess it*; the resemblance is so exact, and the correspondence so peculiar, that reason instructs us to employ our knowledge of the *former*, to guide us to a just apprehension of the *latter*. " God," says Philo, " thought fit to make NOAH both the " *end* and the *beginning* of our race; the end of " that which was *before* the flood, and the begin- " ning of that which was *after* the flood[2]." So similar, indeed, were the positions and circumstances of the *first parents* of both races, and so intricately did the *origins of both races* become at length involved and confounded in ancient tradition;

[1] *Disc. Prél.* p. 30, 31.—*Theory*, § 25. [2] *De Abrahamo*, p. 7.

that we often find the *same region*, and the *same seat*, indiscriminately assigned to the progenitor of each race[1].

We may here observe; that as ADAM, the common parent of the *first race*, was *the channel* through which the knowledge of the important truths imparted by the Creator was transmitted to the *first race;* so NOAH, the common parent of the *second race*, was *the channel* through which that same knowledge was extended to the *second race*. Hence it is, that in the antiquities of the heathen world we discover such manifest evi-

[1] The writers of the Roman Church have preserved a tradition, which would bring those two first parents to the same spot, at the same time. It relates, "that NOAH carried the body of ADAM with him in the Ark; that "after the Deluge, he divided the *created bones*, as a most precious trea-"sure, amongst his sons; and, that the *skull* having fallen to the lot "of Shem, he buried it in the Mount thence denominated *Golgotha*.— "Villalpandus in *Apparatu Urbis Hierus*. lib. i. cap. ix. et Martinus del "Rio in *Panegyrico 7. de Beata Virgine*, ex opinione Honorii Augusto-"dunensis, 'NOEMUM, aiunt, in Arca corpus ADAMI convexisse, et post 'Cataclysmum illius *ossa* ad instar pretiosissimi thesauri pro diviso ejus 'filiis consignâsse; unde Semo, Noëmi primogenito, cum *cranium* ha-'bere contigisset, in Monte *Golgotha* illud condiderat." (*Hiero-Lexicon*, p. 294.)—"It is the universal tradition of the East, that the name *Cra-"nion* (*skull*) was given to Mount Golgotha or Calvary, because the skull "or head of Adam was buried within it.—La tradition de tout l'Orient "est, que le nom *Cranion* a été donné à la Montagne de Golgotha ou du "Calvaire, à cause du crâne ou de la tête d'Adam qui y a été enterré." D'HERBELOT, *Biblioth. Orient.* v. *Cranion*.

> Si nunc se *Physicis* illa ossa reclusa *Parentis*
> Ostendant *nati sine matre!* Æn. vi. 187.
>
> O that, unearthed, to *Naturalists* were shown
> The form of that *ungenerated bone!*

See above, vol. i. p. 78 and 86.

dence of *original identity* in principles and traditions. Hence it was, that the learned Thomas Burnet thus contended: "What should hinder us "from believing, that those *heads of theology and* "*philosophy*, which are found among the ancient "barbaric nations, descended to his posterity, "the persons who lived after the deluge, from "THIS FOUNTAIN, this ORIGINAL MAN, *whose* "*knowledge extended to* BOTH WORLDS? Noah is "reported to have delivered *moral precepts* to his "sons and kinsmen, which are usually called '*the Precepts of Noah*;' and, why not also *doc-*"*trines*, which may as justly be called, *the* "*Doctrines of Noah?* For, as those *precepts* were "not about inconsiderable things, or duties of "little moment, but had a reference to those "which were highly necessary to the *improve-*"*ment of human life;* so, also, these *doctrines* "respect the principal orders and most import-"ant articles of the *natural world;* as, *how it* "*began—in what form and structure it first appeared* "*—what changes or violent motions it has already* "*undergone, or may hereafter endure—whether it is* "*to be dissolved or renewed, and what is to be the* "*last exit and final conclusion of all things.* In "these general and important heads (if I mistake "not) the primeval wisdom was concerned, or "that part of it which had relation to the *world* "and *nature.* Now, NOAH was the *common heir* "of all: therefore, in my opinion, *this* INHABIT-"ANT OF BOTH WORLDS *then delivered the lamp*

" *of learning from* ONE *to the* OTHER; and propa-
" gated through the universe, together with his
" offspring and primitive people[1], some seeds both
" of *natural* and *moral doctrine.* But, in after
" ages they very much declined; and I must
" freely acknowledge, that those seminal doc-
" trines were almost choked by *the prevailing*
" *tares*[2]." In which vicious crop, we know that the doctrine of a CHAOTIC GEOGONY was eminently luxuriant[3]; and we have full proof that it still continues to flourish in the Christian world, under overt or covert cultivation, even in this *nineteenth century of its* SACRED ERA!

[1] See Note [VI.] *On the Eastern Origination of Mankind.*

[2] *De Originibus Rerum*, Pars i. cap. 13.—*Eng. Tr.* 244.

[3] Namque canebat, uti magnum per inane coacta
Semina terrarumque, animæque, marisque fuissent,
Et liquidi simul ignis: ut his exordia primis
Omnia, et ipse tener mundi concreverit orbis:
Tum durare solum, et discludere Nerea Ponto
Cœperit, et rerum *paulatim sumere formas.*
VIRGIL. *Ecl.* vi. 31.

He sang the *molecules* of Nature's frame,
Of air, of earth, of sea, of liquid flame;
How, congregated wide in space, they all
Grew from those elements to this fair ball;
How, the moist soil, condensing *by degrees*,
Press'd from the hardening mass th' exuded seas,
Till Earth at length *Her perfect form assumed.*

Compare, vol. i. p. 23—30.

CHAPTER XIV.

THERE remains a question, which the proposition of the *destruction of the antediluvian earth* will naturally recall to the mind; and which, therefore, must not be passed in this argument without examination, and determination. It will be asked; if the *first earth perished entirely*, what are we to understand concerning the description of the *four rivers of Eden*, enumerated in verses 11, 12, 13, and 14, of the second chapter of Genesis? That enumeration directly *contradicts*, not only the positive declaration of St. Peter, and the prescriptive sense of the ancient Hebrew Church, but also, Moses himself[1]; so that the historian of the *Deluge* is at variance with the historian of the *Creation*, or, in other words, *Moses contradicts himself*. Now, it is an *axiom* in criticism, universally admitted, that no writer of ability and integrity *ever contradicts himself*, and therefore, that all apparent contradictions in his writings must have proceeded from accidental causes open to investigation; and, since this principle applies with its ordinary force to Moses, considered only as a writer of ability and integrity, but with extraordinary force, when he is considered as an *inspired*

[1] See above, chap. iii.

writer; we must endeavour to investigate the *cause* of this apparent contradiction, and to see, whether the inspired text cannot relieve itself from the injury which that contradiction has so long inflicted upon it.

We may not cut the knot of this difficulty with so little ceremony as De Luc; who, without any hesitation, affirms, that the rivers therein enumerated were *not the present Euphrates, Tigris,* &c. but, that they were "*certain antediluvian rivers,* whose "names were afterwards transferred to rivers of "the *new earth;* as is common in *colonies,* where "new places are called after the names of the "mother-country[1]." This is a question, pertaining to a branch of inquiry entirely distinct from *physics,* and not to be solved by the easy process of *gratuitous invention;* yet, it is very material to the present subject, that it should be resolved here.

That this *description of rivers,* constitutes a *parenthesis* intersecting the direct thread of the history, and that it has been inserted for the purpose of *illustration,* is manifest upon the face of the text; but, an important *critical* question arises upon this *parenthesis,* which those will best apprehend who are most conversant with *ancient manuscripts* and with the history of their *transcriptions:* viz. whether this *illustrative insertion* was written by the *author of the history,* or, whether it is not more probable that it was originally a *marginal gloss,*

[1] *Lett. Giol.* p. 327, 8.

which, in process of time, became *incorporated into the body of the text?* To such *insertions*, Bishop Lowth has occasion to advert in his notes on Isaiah; and Kennicott, and De Rossi, have pointedly noticed them, in their observations on the Hebrew text[1]; and there are few ancient authors whose writings have not, in some degree or other, suffered depravation by similar incorporations. Both the Sacred Testaments are well known to have sustained such depravations, in some instances.

In order to illustrate this point for those who may not have had experience in this particular branch of investigation, I shall adduce an unquestionable example of an *incorporated gloss* in the New Testament; which is little known, but which is both very important in itself, and well adapted to expose the nature of similar incorporations.

[1] "To the preceding instances of interpolation (from negligence of "transcribers) one other of a different kind may be added, (says Kenni-"cott,) which deserves our particular attention—I mean, when *additions* "*have been made to any part of sacred history;* which additions, after "being first rashly *inserted in the margin*, have been afterwards injudi-"ciously *taken into the text*. That there are grounds for some complaints "of this nature, is allowed by Grabe, who says—'*Additamenta*, sive teme-'ritati, sive imperitiæ librariorum tribuenda puto: *temeritati* quidem illa '—inserta à quopiam qui operam abusus est suam, ut *historias, adjectis* 'novis quibusdam narrationibus, latius diduceret.' (*De Vitiis* LXX. p. 6.) "Interpretations of this nature, if made *late*, may be discovered easily "by means of the several *ancient versions;* but, if made *early* (a little "before or soon after the birth of Christ,) it may be *now* difficult to dis-"cover them."—KENNICOTT, *Dissert. II. on the Hebrew Text*, p. 417.

"——*glossas* demum, *scholia*, *notas*, tanquam veras lectiones acci-"piunt, et *in textum obtrudunt*."—DE ROSSI, *Variæ Lectiones V. Test.* Prolegom. p. 6.

It is remarkable, that Michaelis has passed over it in his criticisms on St. John's Gospel; Bishop Marsh, however, has duly remarked it in his notes on that work, and has deduced from it the conclusions which it obviously suggests.

In the Royal Library at Paris is a remnant of a very ancient Greek MS. of the New Testament, intitled the *Codex Ephremi*[1]. This valuable relic is pronounced by Wetstein, (in whose enumeration it is marked C,) to be of the same age as the celebrated Alexandrian MS.; but, the passage which I am about to produce, will certainly not tend to diminish its comparative antiquity. Montfaucon has given a *fac-simile*[2] of the first six verses of the 5th chapter of St. John's Gospel, as they stand in this MS.; in which, that portion of the evangelical history is thus read:

μετα δε ταυτα ην ἡ ἑορτη των
Ιουδαιων, και ανεβη ὁ Ιησους
εις Ιεροσολυμα. εστιν δε εν
τοις Ιεροσολυμοις επι τη προ-
βατικη κολυμβηθρα, ἡ επι-
λεγομενη ἑβραϊστι Βεθεσδα, πεντε
στους εχουσα. εν ταυταις κα-
τεκειτο πληθος των ασθενουντων,
τυφλων, χωλων, ξηρων. ην δε
τις ανθρωπος εκει τριακοντα και

αγελος γαρ κατα-
κρον κατεβεν ενεν-
τι κολυμβηθρᾳ και
εταρασε το τῳ
ὑδωρ. ὁ ουν πρωτος
εμβας μετα την τα-
ραχιν του ὑδατος
ὑγιης εγινετω ᾧ αι
ποτε κατηχετω νο-
σηματι.

εκδεχομενον την
του ὑδατος κινησιν.

[1] MICHAELIS' *Introd. to the New Testament*, by MARSH, vol. ii. p. 258.

[2] *Palæograph. Græc.* p. 214, 5.

οκτω ετη εχων εν τη ασθενειᾳ αυτου. τουτον ιδων ὁ Ιησους κατακειμενον και γνους ὁτι, κ. τ. λ.

After this there was a feast of the Jews, and Jesus went up to Jerusalem. Now, there is at Jerusalem, by the sheep-market, a bath, which is called in the Hebrew tongue Bethesda, having five porches. In these lay a great number of impotent folk, of blind, halt, withered. And a certain man was there, which had an infirmity thirty and eight years. When Jesus saw him lie, and knew that, &c.

For an angel went down at a certain season, into the bath, and troubled the water; whosoever then first, after the troubling of the water, stepped in, was made whole of whatsoever disease he had.

waiting for the moving of the waters.

In the Greek MS., the text and the marginal sentences, though both are in the uncial character, are written by different hands; and it will be evident from the *language*, and from the *Itacism* perceptible in the latter, that the latter are of a date *posterior to the former*. It will be equally manifest, that they were *marginal notes*, annexed with the design of *illustrating the popular superstition* under which the infirm man was waiting at the

bath; but, at the same time, *adopting the superstition*, and *averring it to be true*. The original text, was free from that blemish; and, the simplicity and close sequence of the recital, bear *internal* evidence that those marginal passages are *alien to it*. The superstitious clause, therefore, does not pertain to the evangelical historian, but *has become incorporated into his history in the progress of transcription*.

Bishop Marsh thus speaks concerning this passage: "The *Codex Ephrem* has many marginal "notes written in uncial letters, without accents. "This proves what has been sometimes doubted, "that marginal notes were made in the most an- "cient MSS., and that this practice prevailed in "the early ages of Christianity. But, these "marginal *scholia* seem to have been confined to "such MSS. as were in the hands of private per- "sons; while those which have been used for "church service, such as the *Codex Bezæ*, are "without them. It is likewise remarkable, that "in this MS. the disputed, or rather *spurious* "text of John, v. 4, is written, *not in the text*, but "in a marginal *scholion*. Now, as this verse is "totally omitted in the *Codex Bezæ* and the "*Codex Vaticanus*, which are the two most an- "cient MSS. now extant; as it is likewise "omitted in the *Codex Ephrem* (which is inferior "in age to the *Codex Bezæ*), but written in the "margin as a *scholion*; is written in more modern "MSS. *in the text*, but marked with an *asterisk* "or *obelus*, as *suspicious*; and in MSS. still more

"modern is written without any mark; we see "the *various gradations* by which it has *acquired* "*its place in our present text;* and have proof "positive that the verse was originally nothing "more than a *marginal scholion*, and of course "*spurious*[1]."

That copies of the Hebrew Scriptures anciently existed, which exhibited variations arising from glosses and insertions designed as *illustrative amplifications*, may be securely collected from the clause introduced into the Samaritan and Septuagint texts at Gen. iv. 8. "And Cain said to "Abel his brother, '*let us go into the field.*'" Of which passage Origen thus observes: "What is "here said by Cain to Abel *is not written in the* "(canonical) *Hebrew;* and Aquila shews, that the "Hebrews say it exists *in the Apocryphal text*[2]." Hence it is plain, that an *apocryphal text* anciently existed, interpolating in some places the genuine narrative; from whence, an interpolation of *historical interest*, might early have crept into the canonical text.

In the second chapter of Genesis, there ap-

[1] *Introd. to N. T.* vol. ii. p. 732, Note 118.

[2] εν τω Εβραικω το λεχθεν υπο του Καιν προς τον Αβελ ου γεγραπται· και οι περι Ακυλαν ιδιξαν, ότι εν τω ΑΠΟΚΡΥΦΩι φασιν οι Εβραιοι κειμενα τουτο. (*Selecta in Genesim*, p. 76. Ed. Wirceburgi ad ed. Paris. 8vo.)—These testimonies of Origen and Aquila, pointedly contradict the sanguine argument of the author of the *Treatise on the Three Dispensations*, where he affirms—"the Samaritan and Greek have *excellently pre-* "*served* a clause, which does not *now appear* in the Hebrew: "*And Cain* "*said unto Abel his brother*, LET US GO INTO THE FIELD." (Vol. i. p. 8.) It is evident, from those authorities, that it never appeared in the canonical Hebrew.

pears an internal critical evidence of an insertion of the 11th, 12th, 13th, and 14th verses, similar to that of the 4th verse in the chapter of St. John; and constituting, in a similar manner, a *parenthesis* intersecting the thread of the narration, and introduced solely for a similar purpose of *illustration*. It does not wear the character of the simple narrative in which it appears; but, of the surcharge of a *gloss* or *note of a later age*, founded upon the fanciful traditions then prevailing with respect to the situation of the ancient *Paradise*[1]. The reader will find evidence of the unconquered difficulty of reconciling this glossal description with *true geography*, if he consults Michaelis' *Supplementa ad Lex. Heb.* on the names of *Eden*, and of the *four rivers* mentioned in the four verses in question. From all these considerations, therefore, I have long been brought to a persuasion, on *critical* grounds alone, and without any relation to the particular argument of the present treatise; that those *four verses* were a *gloss* of very ancient date, which was received, and became incorporated into, the primitive text, either during the captivity, whilst the Hebrews were actually dwelling in the regions bordering upon the Hiddekel (or *Tigris*) and Euphrates, or soon after their return from that captivity and before the

[1] "The Jews (says Origen,) affirm that Eden was the *centre of the* "*earth*, as the pupil is of the eye."—φασιν (Εβραιοι) Εδεμ μεσον ειναι του κοσμου, ὡς κορην του ὀφθαλμου. (*Sel. in Genes.* p. 72.) It is well known, that the ancient Greeks entertained a similar fancy respecting their temple at Delphi.

translation of their scriptures into Greek; and, that the *text* and the *gloss* stood originally thus:

Now, the Lord God had planted a garden *in Eden*, from the first[1]; and there He put the man whom He had formed. And out of the ground the Lord God had made to grow every tree that is pleasant to the sight, and good for food; the tree of life, also, in the midst of the garden, and the tree of the knowledge of good and evil. And a river went *out of Eden*, for (*or* after[2]) watering the garden; but, from thence (above[3]) it was parted, and divided to four heads (*or* sources). And the Lord God took the man, and put him *into the garden of Eden*, to dress it, and to keep it, &c.

The name of the *first* is *Pison*; that is it which compasseth the whole land of *Havilah*, where there is gold; and the gold of that land is good: there is bdellium and the onyx-stone. And the name of the *second* river is *Gihon*: the same is it that encompasseth the whole land of *Ethiopia*. And the name of the *third* is *Hiddekel*; that is it which goeth *in front of Assyria*[4]. And the *fourth* river is *Euphrates*.

[1] מקדם—Chald. Paraph. "*à principio.*" See Note [VI].

[2] לאחרה—"ל, *ad*, etiam *post*, *postquam*." Noldii *Concord. Part. Heb.* p. 404. "Interdum facit *gerundium*." p. 413, 4.

[3] משם—*inde*: מ, *ab*, expresses equally *ascensus* and *descensus*, *supra* and *infra*, the direction *above*, and the direction *below*. Nold. p. 461, 3, 8.

[4] The *Hiddekel*, or *Tigris*, runs along the *western front* or *face* of ancient Assyria, which looks towards Judea. The word קדם, signifies

That the illustration intended by the *gloss* is unskilful, and does not answer to the text, is manifest; for, the *text* mentions only *one river*, נהר[1], whereas, the *gloss* undertakes to describe *four rivers*. Michaelis shews, that ראשים, *heads*, denotes *sources* in the Syriac and Arabic languages; and he expressly states, that "it never signifies "the *branches of a river* in the Oriental tongues[2]." So that the historian relates: "that God planted "a garden *in Eden—out of which Eden* flowed a "river which *had watered* the garden; but, from "thence, i. e. *upwards, above its exit*, it was dis-"tributed to *four parent heads* or *sources*, issuing "four streams which afterwards united, and "formed *one river* at their departure *out of Eden:* "the *four interior converging streams*, not the *one* "*exterior united river*, irrigating the *Eden* in which "was the *Garden* or *Paradise*." Thus, the *final confluence* of four contributary streams from the *four sources* or *heads* to which the historian traces them *in Eden*, produced the *one river* dis-

both, *ante, antrorsum—before, in front of*, and, *versus orientem—towards* or *on the east;* and much error has been occasioned, by confounding the two significations. In this place, described by a native of Judæa, it manifestly signifies *in front of*, and therefore, *on the west of Assyria;* not "towards the *east of Assyria*," as our version renders it in common with many others. The Greek interpreters have correctly rendered it, κατεναντι Ασσυριων—"*in front of Assyria*."

[1] "נהר *fluvius, flumen*, ab aquis *confluentibus* effectum."—SIMON.

[2] *Suppl. ad Lex. Heb.* n. 2300. "Hoc quidem usu linguarum Orienta-"lium exemploque omnino destituitur.—ראש *caput* fluvii, quod *fontes ejus* "Orientalibus significat, nullo linguarum usu in *brachium* mutatur." n. 2030.—Ambrose renders *initia;* the Vulgate, *capita*.

charging itself *out of Eden*, of which he speaks; which four confluent streams, therefore, cannot have any relation to the *four rivers* recited by the scholiast in the gloss[1]. The younger Rosenmuller, though he interprets "*quatuor fluvii—four* "*rivers*," is obliged nevertheless to acknowledge, "*fluvius ille, ex quo quatuor alii orti sunt,* "*hodie frustra quæritur—that river, out of which* "*four other rivers arose, is in vain sought for at* "*the present day*[2]." Nor can we wonder at this ill success; for, it is the nature of all rivers to *grow by confluence*. No river *separates its waters into different rivers*, unless we choose to give that name to the divisions of its stream by the *delta* or alluvial tract formed at its mouth, in consequence of the perpetual conflict between the sea and its flood; but, this character, it is evident, cannot have any relation to the great mediterraneous rivers enumerated and specified. When, therefore, a recent zealous commentator peremptorily insists, that "*the four Asiatic rivers are geographically* "*marked out, and determined, and identified by*

[1] The error has proceeded, from misapprehending the *reference* with which the historian states the *separation of the waters*, and from assuming, that he refers to the points *towards which they flowed;* whereas, he refers to the points *from which they issued*. The Greek renders, τεσσαρσι αφορισθησαι εις τεσσαρας αρχας. Now ראש (αρχη) signifies both *head or beginning*, and *corner or extremity;* and, from this *double sense* has resulted the *mistake of reference*. The fiction, which made Eden the *centre of the world*, drew on the false interpretation, that *four rivers* flowed *from that centre* to points in the surrounding *circumference*. But, if we consider the text philologically and critically, we shall perceive, that its true import is that which is here exposed.

[2] *Schol. ad. Gen.* p. 23.

" *postdiluvian characteristics*;" and, when a recent Journalist ventures to affirm, " *we find* that the " Assyrian rivers which *originally marked* the " situation of Eden, *retain the same geographical* " *relations*[1];" they shew, that they are perfectly unaware how thoroughly this question has been sifted by the latest and ablest inquirers, and how it truly stands at the present day before the learned world. " Horum nihil cum satisfaciat " (says Michaelis) desperemus Phisonem para- " disi, donec novæ quid lucis adfulgeat.—*Certi* " *quid statuere non licet*[2]." Those writers, therefore, only hold to the ancient error, of which Michaelis says—" *ex conjectura natum, ac vero* " *parum felici*[3]."

But, since all the rivers named in the gloss have their origin *in Armenia*, the *locality alone* enables us to perceive, that its Hebrew author was deeply impressed with the traditions respecting the seat of the *Renewal of the human race*, and that he confounded and identified it with that of its *Origin;* and, that he thus *violently* applied to the *latter*, the characters properly and exclusively pertaining to the *former*, in which *confusion* he is very generally followed even at the present day[4]. The *fluvial description* intro-

[1] FABER'S *Three Dispensations*, vol. i. p. 136: and *British Critic*, No. cxxiv. p. 395.

[2] *Suppl. ad Lex Heb.* No. 2030. [3] Ibid. No. 2300.

[4] Thus, the younger Rosenmuller states of Eden—" *Eden*, is tractus " fuit qui hodie *Armenia*, &c. vocatur:" and of Ararat—" montes *Ara-*

duced into the *four verses*, cannot therefore be regarded, critically, as forming any part of the *Mosaical history;* and consequently, it can have no power to affect the strong evidence which has been deduced from that history, and from the sense of the ancient Jewish and Christian churches, of *the* DESTRUCTION *of the* PRIMITIVE EARTH *by the waters of the* DELUGE.

A cautious and vigilant critic, has well remarked "the dangerous ground of *conjecture;* "which ought never to be admitted, without the "*most obvious necessity*, into *biblical investigations*[1]." Such necessity, can only be constituted by the presence of *direct and positive contradiction*. "Most "certainly, (observes Kennicott,) the closest atten- "tion should be paid to all such mistakes as "introduce *confusion and contradiction*. Neither of "these, could have obtained *originally;* and, both "of them have frequently been objected by the "advocates of infidelity[2]." But, the case before us exhibits a signal example of that *contradiction;* and therefore, of the *obvious necessity* demanding, and therefore warranting, the critical interposition which has been here undertaken. For, the *destruction of the primitive earth*, is, as we have thoroughly seen, a *fact rooted in the very substance*

"*ratici* in *Armenia* sitos esse," &c.: (in Gen. ii. 8. and viii. 4.) a statement, which bears upon its face a very manifest evidence of improbability and confusion.

[1] *Eclectic Review*, for Jan. 1823, p. 53.

[2] *Dissertations*, vol. i. p. 223. See note to p. 419.

of the sacred scriptures, and spreading its root from the text of Moses to that of St. Peter; whereas, the contradiction of that fact contained in the geographical gloss, lies *loosely and unrooted on its surface*, and only on this one particular point of it. Since, then, a manifest contradiction of the *former* is produced by the presence of the *latter*, and since the one must of necessity give place to the other; it is unquestionably the office and the duty of sound and scrupulous criticism, to demonstrate the invalidity of the latter, in order that the important testimony of the former *may stand unimpaired*.

CONCLUSION.

WE have, now, considered the principal arguments which have induced the Mineral Geology to assume, *that there must have been* MORE *general revolutions of this globe than the* TWO *recorded in the Mosaical history;* and we have found, on close and assiduous examination, that the *plurality* thus assumed is the offspring of defective investigation, unregulated fancy, and a determined disregard of authenticated testimony; and, that the "*numerous revolutions*" which it asserts, are all reducible in point of fact, to *those* TWO *only*. We have found—that if "the appearance of the *sharp* "*peaks and rugged indentures* which mark the "summits of the primitive or primordial moun- "tains, and strike the eye at a great distance as "proofs of the *violent manner* in which they have "been formed," is "very different from that of "the *rounded mountains* and the hills with *flat* "*surfaces*, whose recently formed masses have "always remained in the situation in which they "were *quietly deposited by the sea which last covered*

" *them;*" if " calamities which, at the com-
" mencement, have moved and overturned *to a*
" *great depth* the entire outer crust of the globe,
" have, since those first commotions, acted at *a*
" *less depth;*" and, if " *every part of the globe*
" bears the *impress* of these great and terrible
" events so distinctly, that they *must be visible* to
" all who are *qualified* to read their history in
" the remains which they have left behind[1];"—
the *causes* and the *epochas* of these BINARY CHARACTERS *of operation*, are distinctly and lucidly exposed to us by the *Mosaical Geology* in the BINARY REVOLUTIONS which it discloses: so that the *plurality* of these, which the *Mineral Geology* thinks it descries, can only be considered as the *multiplication of objects* to an eye whose organisation is either imperfect or disordered.

In this *second* question therefore, relative to *the* CHANGES *which this globe has undergone since its* FIRST FORMATION and to *the* MODE *by which those* CHANGES *were effected*—the Mosaical Geology has maintained the superiority over the Mineral which it established in the *first* question, relative to *the* MODE *by which that* FIRST FORMATION *was produced*. It has maintained that superiority by shewing, that, in each question, it can endure the most rigid trial by the test both of Newton's principles of *universal philosophy*, and of his method of *analysis* and *induction;* whereas, the

[1] CUVIER, *Theory*, &c. § 6, 7.

Mineral Geology, applied to the same test, is altogether rejected by it in *both questions*. Having therefore ascertained that which we were originally to seek, viz. *which* of the two guides it behoves us to follow as truly "*holding the keys*" of the mineral kingdom of this terrestrial system, and therefore, as alone competent to conduct us, with *perfect security*, to a knowledge of those great *historical secrets of time and nature* which constitute the proper objects of TRUE GEOLOGY; let us now collect, and reduce into order, the *general principles* which we have obtained, and let us sketch out for ourselves a *General Elementary Scheme* which may at all times guide our view in contemplating the general *phenomena* occurring to our observation in the globe, and may secure us against the fascination of *unsubstantial theories*, and the seduction of *illusive analogies*. And,

1. We take our ground upon the concurrent principle of MOSES, BACON, and NEWTON: *That* GOD, *in the* BEGINNING, *created by His power, and set in order by the counsels of His intelligence,* ALL *material things; in such sizes and figures, and with such other properties, and in such proportions to space, as most conduced to* THE END *for which He formed them.* Therefore,

2. That *all the* FIRST FORMATIONS, *in all the three kingdoms of terrestrial matter,* MINERAL, VEGETABLE, *and* ANIMAL, were created *at once;*

equally perfect and complete for the end which *each* was to serve, in *composition*, *structure*, *and arrangement*.

3. That, *after creation*, GOD subjected all those threefold first formations to *certain laws*, by the operation of which, the order which He had *first established* was to be *maintained and continued*: which *laws*, as Bacon inculcates, are the same which *vulgarly*, and *in physics*, are called *the laws of nature*[1].

4. That those *first formations* or *creations* were prepared *with relation and correspondence to the laws which were afterwards to obtain in them*, and, as it were, *in anticipation of their operation*; so that their *phenomena* could not *indicate the mode* by which the formations were *really produced*, although they might *appear to exhibit such indications*.

5. That *our Globe*, thus perfectly constructed at its origin, has undergone TWO *and* ONLY TWO *general changes or revolutions of its substance*; *each* of which, was caused by the immediate will, intelligence, and power of GOD, exercised upon the work which He had formed, and directing the *laws* or *agencies* which He had ordained within it.

[1] "*Laws imposed on matter*, (says excellently Mr. Professor Buckland,) "is an expression which can only denote the *continued exertion* of the "Will of the Lawgiver, the prime Agent, the first Mover." (*Vindic. Geol.* p. 18.) But, if "subserviency to final causes" is only the effect of the *continued exertion* of that will, it follows necessarily, that subserviency to final causes, or *perfect creation*, must have been the effect of the *first exertion* of that will.

6. That, in the FIRST *change* or *revolution*, *one division* of the surface of the globe was suddenly and violently *fractured* and *depressed*, in order to form, in the *first instance*, a *bed* to receive the waters universally diffused over that surface, and, by that means, to *expose the other division*, that it might be rendered a *dwelling for animal life*: but yet, with the *ulterior design*, that the *receptacle of the waters* should eventually become the *chief theatre of animal existence*, by the division first exposed experiencing a *similar fracture* and *a deeper depression*, and thus becoming, in its turn, the *receptacle of the same waters*, which should then be transfused into it, *leaving their former receptacle void and dry*.

7. That this FIRST *revolution* — in which, the *first formations* were rendered *universally fragmentary* in their superior parts by convulsive (we might venture to say *igneous* or *volcanic*) agency, and their fragments subjected to the various and compound action of *internal fires* and of the *oceanic mass* within which those fires operated — took place before the *existence*, that is, before the *creation*, of any *organised beings*.

8. That the waters of the *sea*, collected into that vast *fractured cavity of the globe's surface*, continued to occupy it during 1656 years; during which long period of time they acted in various modes, *chemical* and *mechanical*, on its soils and fragments—accumulating upon its irregular and fragmentary bed *sedimentary deposits*, siliceous,

calcareous, and argillaceous, together with all its varieties of *vegetable and animal productions:* which last, generated in perpetual succession to the *first created individuals*, became multiplied in inconceivable abundance.

9. That, after the expiration of those 1656 years, it pleased GOD, in a SECOND *revolution*, to *execute His ulterior design*, by *repeating* the amazing operation by which HE had *exposed the first earth;* and, by a *similar* disruption and depression of that *first earth* below the level of the bed of the *first sea*, to produce a *new bed*, into which the waters descended from their *former bed;* leaving its *fragmentary* and *sedimentary* materials to undergo the several processes of *desiccation* and *induration*, and its diversified *surface*, loaded with its various *colluvia* or diluvial residue, to become the *theatre of the future generations of mankind, until the* END OF TIME.

10. That THIS PRESENT EARTH, *was* THAT FORMER BED.

11. That it must, therefore, necessarily exhibit manifest and universal *evidences* of the *several vicissitudes* it has undergone; which evidences "*must be visible to all who are qualified to read their* "*history, in the monuments which they have left* "*behind*[1]," by the sure and unequivocal light of THE MOSAICAL GEOLOGY.

[1] See above, p. 245.

Within the limits of this *General Elementary Scheme*, all *speculations* must be confined which would aspire to the quality of *sound Geology*; yet, vast is the field which it lays open, to exercise the intelligence and research of sober and philosophical *mineralogy* and *chemistry*. Upon this *legitimate ground*, those many valuable writers, who have either *incautiously lent their science* to uphold and propagate the vicious doctrine of a *chaotic geogony*, or who have *too cautiously withheld their science* from exposing and refuting it, may geologise with full security; and, transferring their mineralogical superstructures from a *quick-sand* to a *rock*, may concur to promote that true advancement of *natural philosophy*, which Newton held, and demonstrated, to be inseparable from a proportionate advancement of the *moral*. They may thus, at length, succeed in perfecting a TRUE PHILOSOPHICAL GEOLOGY; which never can exist, *unless the* PRINCIPLE OF NEWTON *form the* FOUNDATION, *and the* RELATION OF MOSES, *the* WORKING-PLAN.

Beyond the limit of this *Scheme*, is the region of *shadow and phantasm*. What we cannot find *within it*, is not permitted to the sphere of our *real knowledge*. Let us not, then, strive to fill the inevitable voids in that substantial knowledge, by phantasms collected from the *region of shadow*; nor entertain the pernicious principle, that the *presence of fiction is always more desirable than the*

absence of truth. "*Melius est aliquid nescire secure,* "*quam cum periculo discere.*" To *know* that we *cannot know* certain things, is, in itself, *positive knowledge,* and a knowledge of the most safe and valuable nature; and, to abide by that *cautionary knowledge,* is infinitely more conducive to our advancement in *truth,* than to exchange it for any quality of *conjecture* or *speculation,* however *specious, ingenious,* or *seductive.* It is *this knowledge,* that constitutes our great *preservative against error;* it is, as it were, the *embargo* by which *truth* would prohibit us from passing its frontier, and by that means secure us from the malignant contagion of *scepticism and infidelity.* It, moreover, maintains the *reason* in health; by not suffering the mind to waste its vigour, in the enervating indulgences of the *imagination.*

By adhering to the tried and approved guidance of the *Mosaical geology,* and by directing our view according to the general indication of the *Scheme* which we have here drawn from it; we shall presently perceive *a light* diffuse itself over every object of our contemplation, whether it pertain to the *physical* system, or to the *moral.*

When, thus prepared, we journey amidst the sublimities which the face of this globe presents to our admiration; when, for example, we ascend the upper valleys and climb the primordial eminences of THE ALPS, and survey those awful and magnificent scenes over which *mere physical science* has so long spread a veil "*of gloominess, of clouds*

"*and thick darkness,*" the favourite refuge of the spirits of infidelity;

Dirarum nidis domus opportuna volucrum:[1]

we shall, on opening our *Scheme*, instantly see the darkness dispelled; the exposed night-birds scared, scattered, and gone; and, a bright and serene effulgence invest and sanctify the universal scene. What, before, was all perplexity and all confusion, will at once become order and distinctness; uncertainty and anxiety will be past for ever; and we shall find ourselves able to *read with fluency*, what mere physical science, with all its ingenuity and all its labour, has not been able *even to spell.*

When we behold those stupendous chains of granite summits, whose mural sides lay open to our view and examination their internal substance and texture, we shall survey with admiration a part of the *first formation* of this globe, in its "*skeleton or frame-work;*" the *mode* of which *first formation*, like that of the *bone* of the *first parent*, was assuredly, *creation by the immediate act of God.* We shall guard ourselves against the contradiction of reasoning, from any character *apparent* in that texture, to a *secondary cause*, because we shall be perfectly *sure*, that no character or appearance in *formations by creation* can indicate causes which did not exist until those formations were produced and perfected; and we shall impress ourselves

[1] Æn. viii. 235.

deeply with a sense of the *illogical* and *absurd* quality of all such reasoning, in order that our senses or our imagination may not *seduce* us into the adoption of it. We shall suppose to ourselves the *primitive granite*, the *primitive cedar*, and the *primitive elephant*, present before us; and we shall question our reason, how we could justify to its intelligence the assumption of any difference in the *mode* of their several formations. We shall be sensible; that we must either deny creative formation in the *latter two*, on the sole ground of their *phenomena*, or we must acknowledge it in the *first*, in despite of its *phenomena:* and we shall be further sensible; that, as we should conclude in the *presence of all the three*, so we must conclude in the *absence of any two of them*, if we would establish an unimpeachable title to the quality, I shall not say of a philosopher, but, of a *reflecting and reasonable being*.

When we contemplate the *fractured sides* or *faces* of those granite eminences, the vast masses and blocks *severed from them* and cast and rolled in various places, the smaller fragments and even the crumbled and powdered grains lying in the vast chasms below, or scattered over the valleys and adjacent plains; when we observe the *depressions* of those valleys and plains, until other lines of *stationary primordial eminences* give notice of a continued alternation of similar relations of *height* and *depth;* and, when we extend the same characters, in thought, over the whole surface of

the globe; we shall instantly recognise the evidence of that tremendous operation, *the* FIRST REVOLUTION, the source of all the sublimity which the face of this earth displays, by which *one vast division* of the globe was *suddenly rent and sunk* to receive the congregated waters, leaving only those portions stationary on their bases, to which we give the name of *primordial mountains*. We shall reflect, with astonishment, that a work of such early *apparent* disorder and desolation,

> Crags, knolls, and mounds, confusedly hurl'd—
> Hurl'd by *primeval earthquake shock*,
> And here in random ruin piled;

was *designed* to produce objects of the *grandest character of beauty*, and to become sources of the *sublimest sentiment* to a *future* race of mankind; and, at the same time, to constitute the *vital organs* of a system, by means of which *life* should be circulated to every part of a *future earth*. But, we shall regulate our thoughts of the *magnitude of the ruin* thus occasioned, by the consideration; that the *highest* of those fractured eminences, so stupendous to our apprehension, "are not larger, "with relation to the *mass of the globe*, than the "inequalities on the rind of an *orange* with rela- "tion to the bulk of the fruit; and that, on a "globe whose diameter should be *four feet*, the "*loftiest* of them would not acquire an elevation "of *half a line*[1]."

[1] D'AUBUISSON, tom. i. p. 59.

When, amidst such scenes most distant from the sea, we discover vestiges of *ancient volcanic action* where no such agency has been exercised for many ages; we shall remember, that *volcanic action* proves the communication of the *sea*, at some period, with the *internal fires* constituent in the globe; that the *breach* which first depressed a portion of the *terrestrial crust*, must have occasioned an *extensive communication of the superincumbent waters with those internal fires;* and, that *extensive volcanic action* must have ensued, if not as a *principal cause* of the breach, yet as a *necessary concurrent*. So that the *extinct volcanos*, whose primitive operation is recognisable in all the fragmentary or igneous formations of this present earth, or whose lifeless *foci* are encountered on all parts of its surface, far from betokening to us some remote epocha of *Chaldaic* or *pseudo-geological* antiquity overlooked by the Mosaical record, will be hailed by us as *perpetual evidences of that original reception of the external sea into the interior of the globe, which constitutes the* FIRST REVOLUTION *of the* MOSAICAL GEOLOGY [1].

[1] It is only an act of justice to introduce here the testimony of Dolomieu, little known amongst us, respecting the Canon Ricupero; who is represented by Brydone, in his *Tour to Sicily and Malta*, as having contested the veracity of the Mosaical history upon the ground of the *volcanic phenomena* of Ætna; and of whom, Mr. Greenough has been led by the authority of Brydone to say—"Ricupero counted the beds of lava "upon Etna, and from the average of time which he supposed to inter-"vene between the several eruptions, undertook to calculate the age of "the mountain, and by analogy, the age of the earth." (*Geology*, p. 169.)

What we have before observed of the substance and texture of *granite*, we shall extend to *all rocks of primitive formation*; that is, all crystalline siliceous rocks of that order which extends below all other rocks, which contains no vestige of organ-

" The Canon RICUPERO, (says that distinguished mineralogist,) deserves " neither the praises which have been bestowed upon his science, nor " the doubts which have been raised concerning his *orthodoxy*. He " died without any other affliction, than that which was caused to him by " the work of Mr. BRYDONE. He could not conceive, for what purpose " this stranger, to whom he had rendered services, endeavoured to excite " suspicions concerning the orthodoxy of his faith. This simple man, " very religious, and attached to the faith of his forefathers, was far from " admitting, as an evidence against the book of Genesis, pretended facts " *which are false; but from which, even if they had been true, nothing* " *could have been concluded. Vegetable earths between beds of lava,* DO " NOT EXIST; and the *argillaceous* earths, which are sometimes found " between them, may have been disposed there by causes totally inde- " pendent of the *antiquity* of Ætna. It is not in such facts, that we are " to trace the *age* of that volcano; the *deposits of the sea* which cover its " lavas, are much more certain proofs of its *antiquity*." (*Mémoire sur les Isles Ponces*, p. 470, 1.) Now, we perceive from the Mosaical geology, that, as *primitive volcanic action must have preceded all marine deposits*, so *all marine deposits must necessarily have been subsequent to the primitive discharge of volcanic matter*. The author of the " *Treatise on the Three* " *Dispensations*," unapprised of, or overlooking, the important testimony of Dolomieu, and incautiously adopting the error which that eminent mineralogist rectified in Brydone; affirms confidently — " that there are " many different strata of lava, and that *between each two strata of lava* " *there is a stratum of earth*." (Vol. i. p. 159, 160.) Hence he is drawn into the further error, of arbitrarily converting each of the Mosaic *days* into " *a period exceeding a term of* 6000 *years*," (ib. p. 160,) in order that he may be able to concede, to what he calls " *the decisive dis-* " *coveries of modern physiologists*," the 30,000 years which *he* fancies must have been requisite for the formation of *alternating strata*; strata, which we are at the same time assured, by the highest mineralogical authority, " DO NOT EXIST."

nised matter, in which there exists no evidence of the *recomposition* of a substance *previously decomposed*, but which every where displays that perfect uniformity of *original composition* which cannot be the effect of any known power or operation of what we term *nature*. Being thoroughly *certified* by the principles of true philosophy, that *original* or *first formations* could not have been produced by any *secondary* agents or *laws of nature;* we shall consider the absence of all evidence of secondary causes as demonstration, against all phenomena, that we are engaged with a substance the *mode of whose formation was* DIVINE CREATION.

Here then, upon this ALPINE SUMMIT, instead of the mind roving with remediless uncertainty and increasing perplexity in search of the *primary cause* of the phenomena which we witness in the primeval ruin that surrounds us; instead of committing ourselves to the *blind guidance* of the mineral geology, under any of its Proteus forms—"*prius imperitorum magistra quam doctorum disci-*"*pula*"—or betraying ourselves to the *stratagems* of any mode of infidel sophistry, we shall close the eyes and ears of the *imagination;* and, with the undisturbed illumination of the *reason*, we shall pause and meditate upon the exalted *truths* which reveal themselves before us. We shall become perfectly sensible, that if "*we seek* "*after the Creator*" of this stupendous fabric, we shall most certainly "*feel Him and find* HIM;" for

that, "HE *is not far from every one of* US[1]." We shall be led by the *phenomena* to the presence of God Himself, and shall familiarly apprehend the *first principle of all physical action* in the immediate attributes of the GREAT MORAL CAUSE. The idea of *Nature* will perish from the thought, in the presence of HIM "*the same yesterday, to-day, and* "FOR EVER." In that *presence*, we shall exclaim with the apostle, καλον εστιν ημας ωδε ειναι—"*it is* "*good for us to be* HERE!" And, if we here feel a desire, like him, "*to make a Tabernacle*," or, like the great mineral geologist above cited, "*to* "*build a Temple*[2];" we shall dedicate it to "THAT WISDOM *which was from everlasting,* "*before ever the earth was; by which, the* GREAT "ARTIFICER FOUNDED THE EARTH *and esta-* "*blished the heavens.*"

When, turning from the amazing monuments of that FIRST GREAT REVOLUTION, and from the contemplation of the providence and skill which converted them into essential requisites for the *present earth*, we survey the widely extended *plains* moulded on their irregular bases, and view them, in thought, stretched in succession over the entire surface of the earth; when, we observe the irresistible evidence of the *watery*

[1] Acts, xvii. 27. ζητειν τον Κυριον, ει αρα γε ψηλαφησειαν και ευροιεν.

[2] See above, vol. i. p. 262.

agent, which could *alone* have spread them out in their continuity; when, we see the interior soils of those plains crowded with *relics of marine organic substances*, and observe *similar relics* in many of the highest eminences which rise above them; when, the faces of rocks and the numberless accumulations of their fragments caused by the *first revolution*, shew, by their smooth exteriors, and by the loss of their angles of fracture, *a very long and continued state of trituration in a bed of waters;* we shall be thoroughly *sensible* that we are *standing in the* BED *of a* VAST OCEAN, and shall inquire for the *element which once owned it for its* "PLACE." We shall plainly recognise *the interval of time* which succeeded to that *first* brief but turbulent revolution, and which left the ocean in possession of this *bed* for 1656 years, "*to bring forth abundantly after their kind the* "*living creature that moveth, and to fill the waters* "*of the sea;*" and we shall thus, without any difficulty, explain "*the vestiges of that ancient and* "*long-continued inundation which mineralogists sup-* "*pose to have preceded that of Noah*[1]:" vestiges, for which the mineral geology cannot account, but to account for which, nevertheless, by the rule of its own *inscience*, it demands the *perversion*, if not the *contradiction*, of the Mosaical record.

We shall distinctly perceive, that the *diluvium*,

[1] See above, vol. i. p. 193.

or *deluge of waters*, took place only *upon the earth which was destroyed*, according to the declaration of the record; and, that the *aqueous phenomena* which we witness around us on every side, exhibit the *immediate consequence and perpetual evidence of that diluvium*, in the *vacuity of the bed* from which the waters were *transfused to overwhelm and destroy that former earth*.

The *successions* of the earliest secondary strata which we discover in penetrating into this *evacuated bed*, will demonstrate to us the *primitive operation of the sea* when, on being first drawn into it in the FIRST REVOLUTION, and rushing impetuously downwards into the new profundity, its concentred mass stirred up with violent agitation all the loose or soluble materials of the newly fractured and fallen surface which it there encountered; and left them, whilst it regained its own tranquillity, to be precipitated and deposited again upon its bottom, according to "*the operation* "*of the laws of gravitation.*"

When we inspect hills or mountains whose soils reveal themselves not to be of primitive formation, by the *recomposition* of their substances and by the *foreign organic matter* which they contain[1]; whatever be the *hardness* of their present

[1] Although the ancient heathen writers, (as cited by Mr. Conybeare, *Introd.* p. xxviii. note,) and even Pliny himself, "betray no suspicion "of the true origin" of the organic remains found in limestone quarries, yet, a learned Christian writer of the middle of the eighth century points out their true origin, by means of the light which those heathens did not

texture or the magnitude of their bulks, we shall recognise in them the action of the sea, both during its stationary occupancy, and in the violent agitations which attended the last stages of its retreat; agitations, altering and increasing in mode and power, in proportion as its diminished depth enabled it to transmit the action of its surface, with greater and greater intensity, to the yielding materials of its bed. The *rocky hardness* which many of those masses have since acquired, will declare to us the *mode* by which their former plastic nature has become fixed and consolidated. As, in the *sea-sand* on the coast of of Messina, near the gulf of Charybdis, which remains *loose* and *incohesive* so long as it continues

possess. "That the flood (says Syncellus, Patriarchal Vicar of Con-
" stantinople, circ. A.D. 730) was elevated to the summits of the moun-
" tains, is confirmed to us who write after these things, by the visible
" evidence of some fishes found in our time in the highest summits of
" Libanus; for, those who there cut out stones from the mountains for
" building, find different kinds of *sea-fish*, which, being fixed in the hol-
" low places of the mountains by the mud, have been preserved until
" now in the manner of *salt-dried fish*; so that the truth of the ancient
" history, is confirmed to us by ocular demonstration."—το δι τον κατακλυσμον αρθηναι επι τα ὑψηλοτατα των ορεων, και ἡμιν τοις μετα ταυτα γραφουσιν αληθειαν επιστωσατο αυτοψια τινων ιχθυων καθ' ἡμας ευρημενων ανω προς αυταις του Λιβανου ταις ὑψηλοτατοις ακρωρειαις· λιθους γαρ ενθενδε εις οικοδομιας τινες απο των ορων εκτεμνοντες, θαλαττιων ιχθυων ευρον διαφορα γενη, ἁ δη επι των κατα ορη κοιλωματων συναποκαγηναι τη ιλυι, και τεταριχευμενων δικην εις δευρο διαμειναι συνεβη, ὡστε ἡμιν, δι' αυτης της οψεως, την του παλαιου λογου σωθηναι μαρτυριαν.—GEORGII SYNCELLI *Chorographia*, p. 68.

within the sea, but, when driven *upon the shore* becomes *cemented and indurated, by means of a calcareous fluid insinuated between its particles, into a sand-stone of which mill-stones are made*[1]; so, in the firmest and hardest of these compact rocks we shall discern evidence of their *former softness and pliancy,* until the SECOND REVOLUTION transferred the water from the bed which it had so long occupied, and left those aggerated masses of its basin to a similar process of *conglutination, exsiccation,* and *induration.*

We shall be aware, that the exsiccation of enormous mineral masses, saturated with the water of the sea so as to form a *plastic paste,* and suddenly subjected to the permanent power of *air* and *heat,* and the drainage of their fluid, must, in numberless instances, have been attended with deep *fissures* and *irregular clefts* or *separations of their substance,* and must have been followed by vast *failures* and *settlements;* by which, and by the effects of precedent or concomitant volcanic disturbances, the *planes* of those masses would have been altered from their first directions in various degrees between horizontal and vertical, determined principally by the surface of the *disordered primitive base* on which they had been deposited; and, in the repeated instances of such inclinations occurring to our observation, we shall often see

[1] See above, p. 109.

combined the *united effects of the* TWO REVOLUTIONS.

Of those *two revolutions*, and of the *intervening period of time*, we shall recognise a summary and irrefutable evidence in that species of compound rock which is vulgarly called *plum-pudding stone;* composed of "*conglutinated fragments of primitive* "*rocks*," and found "*in elevations considerably above* "*the level of the present waters of the globe*[1]." The *substance* of the several fragments, will exhibit to us the *grain* and *texture* of the FIRST FORMATION of the rock. The *actual fracture* and *separation* of the parts, will testify the FIRST REVOLUTION; "being fragments of ancient rocks brought to- "gether by some mechanical agent, and the "*results* and therefore the *indications* of *a revolu-* "*tion in nature*[2]," by which, the primitive continuous mass was violently broken in portions of all sizes, from the largest blocks to the minutest sand[3]. The *rounded forms* of the fragments will bear witness to the LONG SUCCEEDING PERIOD, during which they were subjected to incessant *trituration in the sea;* by whose continual action their angles of fracture were gradually worn down, their present surfaces imparted, and themselves finally congregated in a mass of *marine cement*. Lastly; the *present hardness* of that

[1] *Nouv. Dict. d'Hist. Nat.* art. POUDINGUE.—"The interposition "of *pudding-stone*, (says De Luc,) begins even among the primordial "rocks."—GREENOUGH, *Geology*, p. 51.

[2] D'AUBUISSON, tom. ii. p. 205.

[3] See above, p. 60.

cement, by which they are now become consolidated into one compound mass, will attest to us the SECOND REVOLUTION; in which, the *departure of the sea* left it, like the *sea-sand of the Sicilian coast*, to the process of exsiccation, and empowered the chemical principle to act which has effected that close and firm *cohesion* which we witness. In these, therefore, we shall see before our eyes an *epitome of the Mosaic record;* which cannot be read, otherwise than as we here read it. Those several processes must have followed each other, and in the order of succession in which they are here arranged; and they thus correspond to the record, as a *general table of contents*. They note, exactly, the *changes intimated in the record;* and, what is most remarkable, they neither note, nor will admit the introduction of, *any other*. The *last* of which, being acknowledged by the mineral geology to be the *last general revolution* which has taken place in *the earth*, we need not seek for any later.

Finally; when we contemplate the discharge of the primitive sea *to the southward of our present continents*, and yet encounter the spoils of the southern continents which it submerged buried in the *most northern regions of this its primitive bed;* we shall recognise the *ordained*, and therefore the *natural* results of a vast ocean cast against a *southern coast* which presented to it *resistances successively receding;* which successive *recessions of resistance* caused it, in each succeeding *advance*, to

flow forward with a violence continually increasing; and consequently, to *return in every* REFLUX *with a proportionate reaction,* loaded with accumulated spoils animal and vegetable, *into the northern regions from which it had proceeded.*

So long as those alternate *advances* and *refluxes* continued, their effects on the soils of its basin would in a great measure have counteracted each other; but, when it made its *final advance* towards its new bed, which advance was to be followed by *no further reflux*, it is probable, that the violence of its *departing current* would have left some deep and lasting traces of its *southern progress;* and accordingly, such traces are unequivocally left in the *diluvial tract* manifest on all parts of the earth's surface, and, in this island, have been prosecuted with great skill and perseverance by Mr. Professor Buckland in a direction "from War-"wickshire, through Oxfordshire and the valley "of the Thames, downwards to London[1];" that

[1] Transact. of the Geol. Society, vol. v. p. 516. "*Considerations on* "*the evidences of a recent deluge* (*most recent*, p. 520,) *afforded by the* "*gravel beds and slates of the plains and valleys of Warwickshire,*" &c.— See also *Reliquiæ Diluvianæ*, p. 193, 198, 9. I must beg leave, however, to enter my protest against the qualification "*most* recent;" because, we have obtained in the foregoing argument the most solid ground of assurance, that *only one diluvium*, namely, the *entire mass of the primitive ocean*, ever passed over the portion of the globe's surface which we now inhabit; although a vast diversity of powerful effects must have been wrought by it upon that surface in its two different states, of permanency, and of fluctuating progress towards its final departure.

is, in a direction *from North to South*, as the geological exposition requires [1].

We shall thus contemplate, compare, and reduce into their *true order of time*, the effects of the TWO REVOLUTIONS, and of the INTERMEDIATE PERIOD *between the* TWO. To *one* or *other* of *these*, subsequently to *first formation* or CREATION, we shall refer *every revolutionary phenomenon common to the whole earth;* and we shall account it unscientific, unskilful, and visionary, to suggest *any other general revolution* besides these which are so thoroughly and so powerfully authenticated. We shall be quite sensible, that no revolution can have preceded the first of these; that none has followed the last; and further, that none intervened between the two. Where we are absolutely unable to trace *particular relations* between effects and their immediate causes, we shall be aware that we have reached the *boundary of our knowledge;* but we shall never consent, much less shall we *attempt*, to explore beyond that boundary, under the illusory and desperate guidance of *anti-Mosaical theory and hypothesis*. "*Ig-*
"*norance*," said De Luc, "often differs from
"what is called *knowledge*, only by a *less degree*
"*of error*. It ought to be inculcated upon all
"men, that, next to the positive knowledge of
"things which *may be known*, the *most important*

[1] See above, p. 96.

" *science* is to know *how to be ignorant*.—' *I don't* " *know*,' ought to be a frequent answer of all " teachers to their pupils, to accustom them " to make the same answer *without feeling* " *ashamed*[1]." A golden maxim! but, which it behoved the teacher to *practise* as well as to *inculcate*. The French have a rude *truth* in proverbial saying: " *On feroit un gros volume de tout* " *ce que vous ne savez pas*." Shakspeare speaks to the same point, but with more dignity, when he says;

> There are *more things* in heaven and earth, Horatio,
> Than are *dreamt of in your philosophy!*

This is a *truth* which bears with all its force on every one of us, and therefore, with the same force on the *mineral geologist*.

It was doubtless through inadvertency, that a recent able and ingenious critic suffered himself to be drawn into the following remark. " From " *architecture*, the earth derives its *moral* phy- " siognomy. *Inanimate nature*, forms no part of " human nature; it is *only* when we behold the " *productions of men*, that we connect *Her* with " the *human kind*. The *naked spires of primitive* " *granite* losing themselves in the clouds, the " *course of the river*, the *stratification of the soil*, " relate the *revolutions of the globe* during succes-

[1] *Lett. sur l'Histoire de la Terre*, tom. i. p. 228.

" sive ages. Tremendous convulsions are indi-
" cated by these tokens; but, the *accidents of*
" *inert matter* are, *perhaps*, of less immediate
" interest, and *certainly of less immediate import-*
" *ance to us*, than the events which raised the
" *obelisk* and the *pyramid*, the *temple* and the
" *tower*, the *basilic* and the *hall*. These are the
" memorials of human civilisation; marking the
" progress of the mind, attesting man's *power*, his
" *virtues*, and his *crimes*[1]."

I must frankly confess, that my judgment reverses the whole of this reasoning. But then, it is from denying all the premises: that the *spires of primitive granite*, the *courses of rivers*, and the *stratification of the soil*, can only be contemplated as *inert matter*; that the *nature* which produced them is *inanimate* with relation to us, and can only be connected with the human kind in the productions of men; that there is nothing *moral*, in these features of the *earth's physiognomy*; that the *revolutions of the globe* have been mere *accidents of matter*, and therefore, that they are *of inferior importance to* us. From unreservedly denying *all* and *each* these premises, I am obliged to assert; that those *human memorials*, the *obelisk* and the *pyramid*, the *temple* and the *tower*, the *basilic* and the *hall*, with all their melancholy honours of decay, vanish from importance and from thought in a comparison with the *Divine me-*

[1] *Quarterly Review*, No. xlix. p. 117.

morials, presented for the *highest moral contemplation* in the *spires of granite* and the *courses of rivers*, surveyed by the light of the *Mosaical geology*.

The *former* of those monuments, tell us only of that which "*was*" but which is *gone by for ever*, and from which, therefore, *our being* can never derive a positive, real, and permanent interest; whereas the *latter*, in leading the thoughts by an indissoluble chain from that which "*was*" and "*is*," to that which "*is to come*," gives *forethought* of an *interest* most positive, most real, and most permanent. The *Mosaical geology*, in familiarly certifying us of convulsions and revolutions *which have actually taken place in progress*; capacitates us to adapt our forward view to *the revolution which still impends*, and which will *ultimately and certainly take effect*. And, whilst it acquaints us, that "*the earth which* THEN WAS *being* "*overflowed with water perished*," and, that "*there* "*shall be no more* A FLOOD *to destroy the earth*;" it brings the mind into an ability to apprehend the *reality* of that assurance of the oracle which further pronounces, in exposition of the latter sentence, that "*the earth which* NOW IS, *is re-* "*served for* FIRE:" of the *existence* and *presence* of which *element* as a constituent principle in our globe, we *now* possess evidence as sensible, as constant, and as universal, as that which the *first race* of mankind possessed of the surrounding *watery element*, whose agency was foreshewn to

them, by the same oracle, as the instrumental means of the destruction of *their earth* [1]. "The "abundance of *sulphur* in the primitive (or "*deepest*) formations of the crust of our globe, is, "with respect to the study of *volcanoes* and those "rocks through which the *subterraneous fires* "*pierce their way*, (as the mineral geology truly "and awfully remarks) a *far more important* "*phenomenon* than the abundance of *gold* and "*precious metals* which they contain [2]!"

"Of *one departed world*
"I see the mighty shadow: oozy wreath
"And dismal sea-weed crown her; o'er her urn
"Reclin'd, she weeps her desolated realms
"And bloated sons; and, weeping, *prophesies*
"*Another's desolation, soon, in* FLAMES:
"But, like Cassandra, prophesies in vain.
"In vain to many; not, I trust, to Thee [3]!"

With this consideration, therefore, (unless the mind "*be willingly ignorant* [4]" of these two tre-

[1] "By what means was that *Deluge* effected? you will perhaps ask:" (said the heathen Seneca, discoursing on those *unobliterated patriarchal traditions*:) "by the same means by which the future *Conflagration* will be "effected. Both take effect, when God thinks fit that better things shall have "place, and old things come to an end. *Water* and *Fire* dominate in this "terrestrial system: — Qua ratione, inquis? Eadem, qua *Conflagratio* "futura est. Utrumque fit, cum Deo visum ordiri meliora, vetera "finiri. *Aqua* et *Ignis* terrenis dominantur."—*Natural. Quæst.* lib. iii. c. 28.—"J'étais très persuadé qu'il y a par-tout *du feu*: (said Voltaire)

"*Ignis ubique latet, naturam amplectitur omnem.*"

LETTER to BAILLY: *Lett. sur l'Atlantide*, p. 7.

[2] HUMBOLDT, *Superp. of Rocks*, p. 120.

[3] YOUNG, N. T. ix. 127. [4] λανθανει θελοντας. 2 Pet. iii. 5.

mendous revolutions, *past* and *future*, like those persons described by the apostle in his own age,) the thoughts will naturally travel *forward*, in contemplation of *another earth* promised by the same oracle to succeed to *this;* not figurative or allegorical, but real and habitable, though of a very different nature from the present earth; in which, "*man's virtues*" will indeed be admitted, but, from which, "*man's crimes*" will for ever be excluded [1].

This is a subject of contemplation well qualified to regulate and adjust our estimate, both of *this mineral mass* which so powerfully attracts and engages the energies of the *mineral geology*, and of the *pyramid* and *basilic*, the *obelisk* and *tower*, which are wasting to decay upon its surface. It must tend to turn our meditations from too earnest an admiration of this κοσμος—this *material fabric*, to a due contemplation of the Κοσμοποιος—the *eternal and almighty Artificer* [2]; whose *ulterior* purposes with respect to us, are not confined to a structure of *feld-spath*, *mica*, *and quartz*. Μειζω τουτων οψομεν—"*we shall* SEE GREATER THINGS *than these:*" and, if we would but reserve a portion of our *geological interest and curiosity* for that *other earth* after that it shall have replaced the present one, we should soon acquire a sensible conviction of the entire dependence of the *physical* system of

[1] 2 Pet. iii. 13.

[2] See above, vol. i. p. 133.

the universe upon the *moral* system: for, "*seeing* "*all these things shall be dissolved,*" the question would inevitably arise in every breast—"*what* "*manner of persons ought We to be?*" and, thus, all *Natural Philosophy* would be found to merge at last in *Moral Philosophy.*

Thus, the *Mosaical geology* not only directs our view *backward* in time to the *origin* of the globe, but, prohibiting the reason from settling itself exclusively in that view, it irresistibly urges it to look ἁμα πρόσσω και οπισσω—not merely *back* to the *past*, but *forward* also to the *future;* the *latter* of which, is assuredly an object not less worthy of *philosophical contemplation* than the *former*, since the *former we never can witness*, but the *latter we most certainly shall witness.* And thus it will be found, that the earth derives a far sublimer and more profoundly stamped *moral physiognomy* from its features of "*inanimate nature,*" its "*naked* "*spires of primitive granite,*" and its awful "*tokens* "*of convulsions and revolutions;*" than it can possibly derive from all the united productions and memorials which "*man's power and his crimes*" have been able to achieve in *architecture*, from the *first pyramid* raised in *Egypt* down to the *column* in the *Place Vendôme.*

"During a long time," observes M. Cuvier, "*only two events, only two epochas of changes of the* "*globe* were admitted, the CREATION and the "DELUGE; and, all the efforts of geologists were

" directed to explain its actual state, by *imagining* " *a certain primitive state afterwards modified by the* " *deluge*[1]."

" At *that period*," observes M. D'Aubuisson, " when all scientific questions were submitted to " the rule of *theology*, those facts, as manifest as " they were remarkable, (*animal and vegetable* " *substances found in the midst of mineral masses*,) " were ascribed to an UNIVERSAL DELUGE; and " it was long disputed, how it could have effected " them[2]."

I beg leave, in terminating this disquisition, to certify to those two great and valuable naturalists, with all the respect which is personally due to them, and which I sincerely entertain towards them both; that, until they shall " *ask for the* " OLD PATHS, *and walk therein*[3]," until they shall *simplify* their systems, and reduce their " *numerous* " *revolutions*" to the " *two events* or *epochas only*, " the SIX DAYS OF CREATION and the DELUGE," they will never " *find rest*" for their science of *mineral geology*. The difficulties which have attended, and the errors which have followed, inquiries concerning the *fossil phenomena* of the earth, are in no manner chargeable upon *theology*, considered in itself; but have resulted from two separate and opposite causes, *unskilfulness of theologists in physics*, and, *unskilfulness of physical philosophers in theology*.

[1] *Disc. Prél. p.* 19. *Th.* § 19.
[2] *Disc. Prél.* p. 4.
[3] Jerem. vi. 16.

When I thus use the word *theology*, I do so improperly, and only in conformity to the writer last quoted; for, the question does not pertain to *theology* generally, but, to that part of it alone which respects the *sacred history* in particular. I should therefore have said with more propriety, that those errors have resulted from unskilfulness of *theologists in physics*, and of *physical philosophers in the sacred history*. The question at issue, is a *compound question*; it is both *physical* and *historical*; for, it seeks the *historical truth* of a *physical fact*. It is, therefore, indispensably necessary to understand thoroughly, both the *physical fact* which is to be accounted for, and the *history* which accounts for it; before we can be duly prepared to assert, or to deny, the *concord of the history with the fact*. Theologians, formerly, were not accurately skilled in physics, and, physical philosophers were very imperfectly instructed in the history, that is, in the *original document*; and, from thence resulted great and irreconcilable discordancies between them. But, many theologians, at the present day, apply their minds to *physics* with the same ardour as physical professors; and, if the latter would apply their minds, with the same diligence and industry, to scrutinise and understand the *sacred history*, the result would probably be an *union of opinions* in both, and an ascription of *all* the general revolutionary phenomena of the earth to those *two events* only, the CREATION and the DELUGE; that is, to the BINARY REVOLUTIONS

effected during those two great periods, including the TIME INTERVENING BETWEEN THE TWO: as, I think, has been not unsuccessfully shewn in the preceding discussion.

And here I must freely acknowledge, that if *physical science* has often betrayed a precipitate and irreverent temper, in rejecting the causes assigned from the record by *theological learning* for the mineral phenomena of the globe; *theological learning*, on the other hand, has not been sufficiently *accurate*, in the exposition of the record which it has presented to *physical science* for its acceptance. It has propounded *only* ONE *universal revolution* of the globe, inadequate to all the effects which are so manifestly experienced; and "which (to speak with Mr. Conybeare,) cannot, "without violating every rule of physical reasoning, be ascribed to *that* ONE *convulsion*[1]." Physical science therefore, sensible of this truth, and erroneously deeming itself destitute of all historical guidance, plunges into the opposite extreme; and imagines an *indefinite* PLURALITY *of revolutions*, which never really took place. Whereas we have seen, that THE RECORD most distinctly differs from both, and points out to us TWO, *and only* TWO, *universal revolutions*. But, those TWO, sufficiently indicate the *causes* of all the revolutionary

[1] *Introd.* p. lviii. note. With respect to an observation in that note, on "rounded fragments of bituminous limestone;" see above, a suggestion on the different actions of *trituration* and *conglobation* in producing the rounded forms of different pebbles, p. 117.

phenomena for which ONE *revolution was insufficient*, and for which *more than* TWO *are unnecessary*. And therefore, it now behoves the *Mineral Geology*, upon every principle of physical and moral reasoning, to return from the theoretical excursions into which the *insufficiency of* ONE *revolution* had driven it; and to *conform* and *adapt* its science to so authoritative a document, after that its contents have been thoroughly investigated, and its validity and consistency irrefutably demonstrated. The *onus* of disproving this position, is now thrown on the *mineral geology*. In order to be able to do this, it must clearly and truly *shew*, either 1. that the *interpretation* which has been here given of the history, is *incorrect and fallacious*; or, 2. that the *inductions* drawn from that interpretation, are *unsound and false*; or, 3. that they are absolutely contradicted by the *actual observations of nature*. Until it can do one or other of these, the *Mosaical geology* here exposed, will keep the field. If the mineral geology can do this, the Mosaical must of course recede; but, if it *cannot do this*, then, to pursue its former inveterate course in resolute disregard of the latter, will be to persevere in *willing obscurity*, and willingly to encounter all the misadventures and failures which such perseverance must necessarily entail.

I do not include in these last remarks its *chaotic revolutions*, devised for the sole purpose of maintaining a *chemical mode of mineral first-formations*, and which pertain to the *two preceding parts* of

this inquiry; all those *deliraments*, like "*gorgons*, "*and hydras, and chimeras dire*," and all other spawnings of a misordered fancy, are to be at once extinguished upon *another account;* their intolerable offence to *genuine reason, sound philosophy*, and *true religion*. So long as the mineral geology shall continue to rest its science upon such *phantasmata*, it will be as remote from the real truth of things as "*the chanter of Nature*."

If it be asked, to which *form* of the mineral geology I particularly direct this stricture? I answer, *equally to every form;* to the primitive *amorphous mass*, as well as to the primitive *elemental chaos;* to the action of "*fire from below* "*upwards*," as well as to that of "*water from above* "*downwards*," in FIRST FORMATIONS. Certainly, none is better entitled to the stricture than the *Protogæa*[1], or *geological hypothesis* of the celebrated Leibnitz; the great rival and antagonist of our own superior Newton, whose *characteristic principle* was, "HYPOTHESES NON FINGO—I FRAME "NO HYPOTHESES[2]."—"*I Believe*, (professed that "other bold and fearless hypothetist,) that *our* "*globe* was at one period in a state similar to "that of a *burning mountain:* the *rocks*, which "are as it were *the bones of the earth—les ossemens* "*de la terre*—were the *scoriæ*, or vitrifications of "that *ancient confusion;* the *sand*, is nothing but "the *glass* of that vitrification pulverised by

[1] *Acta Erud. Lips.* Jan. 1693, p. 40.

[2] *Schol. Gen. Pr. Math.* iii. *in fin.*

" motion; the *water of the sea*, is a sort of *oleum* " *per deliquium*, caused by *cooling* after calcina- " tion. Here, then, are *three* materials widely " extended over the surface of our globe, namely, " the *sea*, the *rocks*, and the *sand*, explained " *naturally enough by* FIRE; and which *it would* " *not be easy to account for by any other* HYPO- " THESIS. This *water*, at one period covered all " the globe, and caused in it *many changes* even " before the deluge of Noah[1]."

In this portentous formulary of *hypothetical faith*, we can have no difficulty to perceive, (and it is a solemn warning to *all Mineral Geology*, whether neptunian or vulcanian,) that the sublimest intelligence, when it *forces* a progress beyond the guidance of *reason and evidence*, and is determined to travel forward under the conduct of *fancy and speculation alone*, passes into a lunar sphere; and the quintessence of ingenuity which it there concocts, is indeed found, on *cooling*, to be a production *per deliquium*—*sc.* " *sanitatis ac* " *mentis*." The MODE *of the first formations of the mineral substances composing this globe*, is a *matter of fact* which lies as far beyond the scrutiny of any *mineral geology*, whether by scientific inspection or chemical analysis, whether by the method of *water* or the method of *fire*, as the MODE *of the first formation of the bones of Adam*, or *of the wood of the trees of Paradise;* and it is

[1] LEIBNITZII *Opera*, tom. vi. p. 213.

not *theology* that pronounces this, but, " *sound* " *physics, exact logic, and the philosophy of Bacon* " *and Newton.*"

We are told that Archimedes affirmed, that he could raise the globe of this earth by the powers of mechanism, *if* he could only find a *place* on which to fix the *fulcrum* of his lever; but, as he knew that he could not find such a place, he did not give himself the trouble to seek for it. The CHAOTIC GEOGONY, on the contrary, in its attempt to determine the mode of first formations by secondary causes, resembles Archimedes and his school, not merely *seeking* for the place, but, *confident that they had found it and busily engaged in the operation of elevation;* and, the contradictory hypotheses of that geogony, resemble the disputes which in that case might be supposed to have arisen, concerning the *fittest point of the place for fixing the fulcrum.*

I find, in the beginning of the " *Golden Remains* " *of the ever memorable* JOHN HALES," the following singular passage.—" G. Agricola, writing *de* " *animantibus subterraneis,* reports of ' a certain ' kind of spirits that converse in *minerals,* and much ' infest those that work in them; and the manner ' of them when they come, is, to seem to busie ' themselves according to all the custom of work- ' men; they will dig, and cleanse, and melt, and ' sever metalls; yet, when they are gone, the work- ' men *do not find that there is any thing done.*' So " fares it, with a great part of the multitude, who

" thrust themselves into the controversies of the " times; they write books, move questions, frame " distinctions, give solutions, and seem sedulously " to do whatsoever the nature of the business re- " quires; yet, if any skilful workman in *the Lord's* " *mines* shall come and examine their work, he " shall find them to be but " *Spirits in Minerals;*" " and that, with all their labour and stirr, *there is* " *nothing done.*" It is impossible not to perceive, how accurately this representation describes the results of the efforts of *Mineralogy* when it *quits its sphere,* and when it strives, by the solitary powers of its own science, to effodiate the *fundamental truths of Geology.* After all its labour and stirr, all its books, distinctions, solutions, and chemistry, it is easy to discern, " *that there is nothing done.*" One while it works with *water,* another while with *fire;* yet, after all, no *fundamental geological truth* is brought to light. And, for this one plain reason; that there is *no instrument whatever* that can have power to bring out, or power to reach, that profoundly latent truth, but the *Word of* GOD Whose secret alone it is, and Who alone is able to divulge it. When once this infallible principle is thoroughly apprehended by the intelligence, it contemplates, with unfeigned regret, the efforts of genius which have been expended in striving to attain an end, which, by its nature, is and must ever be *unattainable.*

I here close this *Comparative Estimate* of the TWO GUIDES which offer to conduct us to a *secure*

knowledge of the history of our globe, with respect to the MODE *of its* FIRST FORMATIONS *and the* MODE *of its* SUBSEQUENT CHANGES. It only now remains for us, *to determine our election between the* TWO; and to decide, whether we will choose the MINERAL GEOLOGY, with its *nature* and *time*, its *chaos* and *chemistry*, or, whether we will unite with BACON and NEWTON in adhering firmly to the fundamental principles of the MOSAICAL GEOLOGY, arising, altogether and exclusively, out of the CREATIVE WISDOM, the CREATIVE POWER, and the CREATIVE FIAT, of ALMIGHTY GOD.

SUPPLEMENT

TO

CHAPTER VI.—PART III.

PAGE 123.

On Caves in Limestone Formations, at Kirkdale and elsewhere, containing Fossil Animal Exuviæ.

I HAVE found myself compelled to contest the *particular geological explication of the* KIRKDALE *phenomena* which has been proposed by the eloquent Professor of Mineralogy, because, whilst it places itself in array of direct opposition to the connected and unbroken chain of deductions which has been drawn out in the preceding argument, in evidence of *diluvial transport*, it is, in truth and plainly, not deduced by scientific or philosophical *consequence* from any *first principles* legitimately productive of it; but, is altogether an *insulated hypothesis*, taken up *in medio* of the subject, and principally governed and determined by the necessity of assigning a cause to *one particular circumstance* in the phenomena, viz. the *disproportion* between the *dimensions of the orifice* of the cave, and the *natural bulk* of the large animals whose *exuviæ* are found within it; and assuming gratuitously, and without essaying the powerful evidence of the *marine incorporations*, that the limestone *must necessarily* have existed in its present consolidated state, and with its present cavity, at the time when the ani-

mals were first lodged within it[1]. With this partial and uncombined view of the phenomena, it propounds at once, without laying any preparatory ground capable of sustaining the proposition, and without anticipating the very awkward consequences which must inevitably attend its admission, that the Cave at Kirkdale *was*, previously to the catastrophe of the deluge, *a den of indigenous hyænas;* into which they conveyed their prey consisting of various animal *genera*, of which, some now exist only *within the tropics*, but, in that distant period, *were native inhabitants of antediluvian Yorkshire.* And, because *entire carcases* of elephants and rhinoceri were *too large* to have passed through the actual orifice and channels of the *den*, it at once assumes as an undeniable corollary or accessory, that the hyænas must have introduced them *through that orifice*, " piece-meal and by fragments, into the inmost " and smallest recesses in which they are found[2]," either by individual industry " or acting conjointly " with others[3]." But, when we see a horse or a cow through a chink in a wall, we do not suppose that it must have passed through that chink; and therefore, when we find an elephant or a rhinoceros lying beyond and within a chink or fissure in a desiccated calcareous mass, too small to have admitted it, we are not authorised to assume, at once, that it must necessarily have passed through that chink, and to propose the *means of its passage*, unless it is quite certain that it could not possibly have gained its position *by any other means;* which, we have seen, is very far from being the case.

Yet this assumed *hyænas' den*, which the sanguine author of the hypothesis confidently affirms to be a *certain* and *established fact*[4], is rendered by him the *great*

[1] *Reliquiæ Diluvianæ*, p. 10.
[2] Ibid. p. 16.
[3] Ibid. p. 37.
[4] Ibid. p. 96, 162.

DETERMINER *of all geology.* After speaking in another place, of the fanciful causes heretofore assigned to similar animal phenomena, he thus concludes: "The "*more rational idea,* that they (the *fossil exuviæ*) were "drifted northwards by the diluvial waters from tropical "regions, MUST *be abandoned on the authority afforded* "*by the* DEN *at Kirkdale; and it* NOW *remains only to* "ADMIT, *that the animals* MUST *have inhabited the countries* "*in which their bones are* FOUND[1]." The evidence which is to sustain this hypothesis, is thus formally and distinctly acknowledged by the author himself, to be the *only obstacle* that can withstand the complete establishment of the "*rational idea of* TRANSPORT;" which "*rational idea*" needs only to give place to the *particular evidence* afforded by the DEN. But, he thus unwarily stakes the whole of his own geological argument on the *certainty of that den;* which, it will be seen, is a very precarious pivot on which to trust so weighty and important a superstructure. The equity of this highly respected writer must here, therefore, perceive, and will, I am well convinced, as candidly acknowledge, that he has himself imposed upon me the ungrateful task to which I very reluctantly submit,—of endeavouring to make an effectual experiment, whether the *rational doctrine of transport* maintained in the preceding argument, "MUST *be abandoned on the sole authority of* "*the den at Kirkdale,*" and, whether there remains *no other alternative* than to "*admit,*" that the animals, whose remains are found in the cave, "MUST *have once inhabited it.*"

I am well aware, that it has long been a common resource of many who, after laborious and hazardous enterprises to collect facts in geology, find the conclusions which they have drawn from those facts questioned by others who have not engaged in the same particular enter-

[1] *Reliquiæ Diluvianæ*, p. 173.

prises, to exclaim, that the objections are those of "*mere* "*cabinet naturalists*[1]," who have not inspected the objects on which they pretend to deliver an opinion. But, this "argumentum ad *silentium*" has no title to *produce it;* for, *the facts reported, are certainly of no value whatever to science, if they do not enable all reflecting and philosophical minds to reason effectually and conclusively upon them;* and, no one can at the same time, both impart his knowledge to others, and keep it all back to himself. And, that the sobriety of "*the cabinet*" is materially needed to revise and regulate the often hasty and impassioned combinations of *actual inspection,* is virtually admitted in the concession of Cuvier; "that many who have made excel- "lent collections of observations, though they may have "*laid the foundations* of true geological science, have not "therefore been able to *raise and complete the edifice*[2]." Besides, it does not follow, because a writer *meditates in his cabinet,* or, because he has not visited the limestone caves of England and Franconia, that he has not *made researches out of it;* or, because he abstains from a recital of his travels, that he has not explored the *mountainous chains of the Alps,* or the *Pyrennees,* or sought the interior of the earth in various places, as, at *Hallein* in Salzburg, *Bex* in Switzerland, *Mont St. Pierre* near Maestricht, and elsewhere; which are no negative instructors in preparing the mind for geological investigation[3].

[1] Cuvier, *Disc. Prélim.* p. 25. *Theory,* § 21. [2] Ibid.

[3] The Edinburgh Reviewer also, in order to walk over an argument which he does not care to encounter, affirms roundly, (but with courteous qualification), "that the *Comparative Estimate* is the production of one, "who writes after *reading* very largely upon geology, and *seeing* very "little of the actual appearances of the earth." (No. lxxvii. p. 206, note,) Yet, the Reviewer is perfectly ignorant of what the writer has *seen* of those actual appearances: but, Reviewers, like Pleaders, often allow themselves questionable latitudes of assertion, as *make-weights* in the arguments which they are striving to establish. See vol. i. p. 50, 51.

The ingenious and animated author of the hypothesis commences his discourse by observing—that the *phenomena of the cave,* " seem calculated to throw an important " light on the *state of our planet* at a period antecedent " to the last great convulsion which has affected its sur- " face;" and, " that they afford one of the most com- " plete and satisfactory *chains of consistent circumstantial* " *evidence* that he has ever met with in the course of his " geological investigations[1]." Yet, to make good these pregnant and comprehensive positions (which are not *proportionately illustrated and explained*), and to secure his subsequent extensive conclusions respecting the *reality of the* DEN, he lays the *whole ground* of his argument within the narrow compass of *these three heads:* " 1. The geological (more properly mineralogical and to- " pographical) *positions* and *relations* of the rock: 2. A " description of *the cave:* 3. A particular enumeration of " the *animal remains* there inhumed:" points, very inadequate to substantiate the *historical fact* which he would establish[2]. From this confined and narrow ground, how-

[1] *Reliquiæ Diluvianæ,* p. 1, 2.

[2] " The cave is situated in a *compact bed of oolitic limestone,* which " lies between two beds of the coarser oolitic variety; the latter varying " from light yellow to blue, the former from dark grey to black. The " compact portion partakes of the property common to *compact limestones* " of all ages and formations, of being perforated by irregular *holes and* " *caverns intersecting it in all directions.*—The original entrance to the " cave is said to have been *very small:* nearly 30 feet of its outer extre- " mity have been removed. The present entrance is a hole in the per- " pendicular face of the quarry about three feet high and five feet broad; " which it is only possible for a man to enter on his hands and knees, " and which expands and contracts itself irregularly from two to seven " feet in breadth, and two to fourteen feet in height; diminishing, how- " ever, as it proceeds into the interior of the hill. The cave is about " twenty feet below the incumbent field, which is about eighty feet " above the stream of the Hodge Beck. Its main direction is E.S.E.,

ever, he adventures to expatiate at once to his remote and eventful *conclusions*, respecting *the cave*, and respecting the *animals* found within it.

Of the former, he thus very speedily concludes: "It "must *already appear probable* from the *facts* above de- "scribed, *particularly* from the comminuted state and "*apparently gnawed* condition of the bones, *that the* "*cavern at Kirkdale* WAS, *during a long succession of* "*years*, INHABITED BY HYÆNAS.—*I do not know what* "*more conclusive evidence can be added to the facts already* "*enumerated, to shew that the hyænas inhabited this cave;* "*and were the agents by which the teeth and bones of the* "*other animals were there collected*[1]." In the full security

"but deviating from a straight line by several zigzags to the right and "left. In its interior it divides into several smaller passages. In its "course it is intersected by some vertical fissures. There are but two or "three places where it is possible to stand upright. On advancing some "way into the cave, the roof and sides were found to be partially studded "with *stalactite*, which was most abundant in those parts where the "transverse fissures occur. On tracing the stalactite down to the mud, "it was there found to turn off at right angles, and to form above the "mud a plate or crust. Only a very few bones have been discovered "that are tolerably perfect; most of them (consisting of those of *hyæna*, "*tiger, bear, wolf, fox, weasel—elephant, rhinoceros, hippopotamus, horse* "*—ox*, and three species of *deer—hare, rabbit, water-rat, mouse—raven*, "*pigeon, lark, duck*,) are broken into small fragments; the greater part "of which lay separately in the mud, whilst others are wholly or par- "tially invested with *stalagmite*, and others again mixed with masses of "still smaller fragments and cemented by *stalagmite*. They were found "in greatest quantity near the mouth of the cave. The effect of the *loam* "and *stalagmite* in preserving the bones by protecting them from all "access of atmospheric air, has been very remarkable. Nearly the "whole of the gelatine has been preserved. The bones are not mine- "ralised, but simply in the state of grave bones more or less decayed or "incrusted by *stalagmite*." (*Reliq. Diluv.* p. 4—13.) The reader will afterwards compare this description of the *Cave at Kirkdale*, with that of the *Cave at Durfort* containing *human bones*: Note [V].

[1] *Reliquiæ Diluvianæ*, p. 19, 20.

of which *evidence*, he elsewhere describes (what he supposes to have been) antediluvian Britain,—"*a land inhabited, as "this* WAS, *by wolves and hyænas*[1]."

Of the latter, he finally concludes thus: "The *only* "remaining hypothesis that *occurs to me* is, *that they* (the "animals) *were dragged in for food by the hyænas, who "caught their prey in the immediate vicinity of their den; "and, as they could not have dragged it home from any "very great distance, it follows, that the animals they fed "on all lived and died not far from the spot where their "remains are found*[2]." And, with the same security as before, he is brought to speak in another place, of "the "*certainty* of the bones having been *dragged* by beasts of "prey into the small cavern at Kirkdale[3]." Thus, that "most complete and satisfactory chain of consistent cir- "cumstantial evidence," stated in the first instance, does not appear to connect any thing more than the *general postulated conclusion*—that the animals *lived in Yorkshire*, with the *equivocal premises*—that their remains are *now found there*[4].

I am here imperatively compelled, in manifest consistency with the argument which I have undertaken in the preceding treatise, to remark; that the *process* by which those several conclusions are obtained, appears to be precisely the same as that by which the mineral geology was shewn, in the first Part of the foregoing treatise[5], to have

[1] *Reliquiæ Diluvianæ*, p. 77. [2] Ibid. p. 40. [3] Ibid. p. 96.

[4] This statement was first written, on the perusal of the paper in the *Philosophical Transactions*; and I find nothing, in the subsequent extension of that paper in the *Reliquiæ Diluvianæ*, to make it requisite for me to alter it. The *hypothesis* had established itself *conclusively*, before the publication of the important details and comparisons which the latter valuable work contains; which details and comparisons are adduced, not as constituting any part of the *foundation* of the hypothesis, but only as supplying *collateral strength* for its support.

[5] See above, Part I. chap. iv.

peremptorily inferred from the *spherical figure* of the earth, that it "*really* WAS *once fluid*;" and the conclusions appear, in both cases, to rest upon the same seductive and ensnaring principle, which so commonly imposes itself upon the mind under the plausible character of *self-evidence*[1]. Under the illusion of that most fallacious principle, the same *sudden bound* is made, in both arguments, from the *premises* to the *conclusion*, over the heads of a long series of interposing and inflexible *negaturs*; and it is almost superfluous to observe, that all inductions or corollaries drawn from a conclusion *erroneous in the first instance*, must necessarily *inherit the vices of the parent error*.

The whole of the solution proffered in this hypothesis of the *hyænas' den*, however ingeniously inventive and however graphically descriptive, bears yet too decidedly the appearance of a *forced proof* to be embraced with any degree of philosophical confidence; and is obnoxious to many unsurmountable objections, some of less, and some of greater moment, of which, the former only regard the correspondence of the *cave* with the characters of an *hyæna's den*, alleged by the hypothesis; but, the latter go to affect the fundamental principles of *true geology*, a *science*, which cannot with any assent of enlightened reason be regarded, like *mineralogy*, as *merely physical*. The principal of these objections, I shall now summarily consider; and,

1. The hypothesis, not only grounds itself upon the fallacious inference, that hyænas and other equatorial animals *must have inhabited Yorkshire, merely because their exuviæ are now found there;* thus concluding, at once and definitively, *from actual to primitive locality*[2]; but, it avoids all *adequate* effort of previous inquiry and investigation,—whether the carcasses of those animals, being

[1] See above, vol. i. p. 90, note.

[2] See above, p. 84, 85, note.

moveable bodies, might not have been *removed* to their actual stations?—whether any power *capable* of removing them, *exists* in nature?—whether such power, if it does *exist*, has ever been brought into *actual operation*?—and whether, if it has been brought into actual operation, it was *competent to produce the phenomena which are witnessed in the cave:* connected considerations, of which, in their sequence, sound philosophy and cautious inquiry will by no means suffer any one to be set aside, but which, nevertheless, are entirely set aside in the *hypothesis*, on the sole authority of the *assumed self-evidence of the* DEN.

2. Again; the cave at Kirkdale contains, we are told, innumerable *bones*, not only of elephants and of the larger quadrupeds, but also of *water-rats*. The *cause* of the presence of these bones, in all their diversities and disparities, must be *one and the same*. That *one cause*, according to the *hypothesis*, was—IMPORTATION *by hyænas, of the several animals to which they pertained, for the purpose of food.* Now, the bones of the larger animals are supposed by the hypothesis to have *resisted the teeth* of the hyænas, and *therefore* to have been only "*gnawed*" by them; could the hyænas have *masticated* them, they would not now remain in evidence. This "*apparently* "*gnawed condition of the bones,*" is, indeed, as we have seen, the circumstance which is "*particularly*" to establish the "*probability, that the cavern was, during a long* "*succession of years, inhabited by hyænas;*" nor does the hypothesis "*know, what more conclusive evidence can be* "*added to shew it.*" But, the same cannot be argued of the innumerable bones of *water-rats*, which equally remain. The presence of these minute and *masticable* bones, therefore, refutes the cause assigned for the presence of the large and *unmasticable* bones; for, no one would conclude, that hyænas spared the bones of *rats*, merely because they

could not masticate those of *elephants*. Certainly *not*, replies the hypothesis; but, "in masticating the bodies "of these small animals with their *coarse conical teeth*, "many bones and fragments of bones would be *pressed* "*outwards through their lips*, and fall *neglected* to the "ground[1]."

This retort, is indeed quite unexpected; yet surely, if we ever witnessed the fate of a mouse in a cat's mouth, we are perfectly competent to judge, whether so *small* and friable a mouthful as the body of a *water-rat*, within the jaws of a hungry *hyæna*, would be likely, notwithstanding the coarse conical teeth of the latter, to eject any bones or fragments of bones to testify of its fate. Or, if it did, since the hypothesis instructs us, "that the hyæna is *greedy of* "*bones beyond all other beasts*[2]," it would seem to follow, that they would not have remained *neglected* in the presence of so many hyænas, both old and young, as the hypothesis assumes to have coexisted in the cave; for, so decided is this *appetite for bones*, that the hypothesis is led to conjecture, that even the *horns of deer* which have been there discovered, did not pertain to any *prey*, but that, after "having fallen off by necrosis, they were "*found shed* by the hyænas, and were *dragged home* by "them for the purpose of *gnawing them in the den*;" and it adds, "to animals so *fond of bones*, the spongy interior "of the horns would not be unacceptable[3]." The hypothesis moreover asks: "If *bears* eat *mice*, why should not "*hyænas* eat *rats*[4]?" I know no reason why they should not, nor will it in any manner affect the argument, whichever way the fact shall be finally determined; but, if they are so peculiarly fond of bones, and yet so awkward as to drop them in the actual eating, it is most probable, that they would

[1] *Reliquiæ Diluvianæ*, p. 34.
[2] Ibid. p. 20.
[3] Ibid. p. 32.
[4] Ibid. p. 34.

" have gratified their natural propensity[1]" by resuming them as soon as they felt the calls of hunger return, instead of " neglecting" them. That remarkable " *fondness* " *of bones,*" therefore, which the hypothesis ascribes to the hyæna, seems to furnish, of itself, a very strong presumptive evidence; that this rich *treasury of bones*, of all magnitudes, was never in the power of a confraternity of hyænas " *whose habit it is to devour the bones of their* " *prey*[2]."

3. The hypothesis pronounces, that certain " small " balls which were discovered in the cave," and to which it assigns the name of *album græcum*[3], are the *excrement* of the antediluvian hyænas which it supposes to have inhabited the cave. The substance of this assumed *excrement*, is stated to be " *solid* and *calcareous* — to retain *no* " *animal matter*—to betray an *earthy nature*—and *affinity* " *to bone*." But, the *sediment* in the cave, on which those small balls lay, is represented to be " *a soft mud or loam*— " mixed with *much calcareous matter*—which seems to be " derived in part from *comminuted bones*[4]." The close analogy thus acknowledged to subsist between *these two substances*, awakens a very reasonable suspicion, that the former were only accidental conglobations of the decomposed *osseous matter* which must have been abundant on the surface of the sediment, which might have acquired a diversity of colour and character from having been separated from the general mass; the surface of which mass, as the hypothesis relates, though " in general smooth," had yet been " *ruffled by the dripping of the water*[5];" and, in those *rufflings*, small balls of the soft *calcareous* or *bony matter* might very possibly have been conglobated by the action and reaction of the dripping water: which, being

[1] *Reliquiæ Diluvianæ*, p. 37. [2] Ibid. [3] Ibid. p. 20.
[4] Ibid. p. 10. [5] Ibid.

thus detached, and acquiring from that circumstance, and the indurating quality of the fluid[1], the *solidity* which they exhibit, would very naturally suggest the idea of the *fæces* of the animals, when once their *inhabitation of the cave* had established a firm conviction in the mind. And, this conjecture is rendered more probable by the consideration; that, if the animal fæces *could have remained in the cave undissolved by the diluvial waters,* which the hypothesis supposes to have *occupied it during the period of their continuance on the earth*[2], an *accumulation* of the *same substances* would probably have been discovered *underneath the diluvial mud,* answering by *proportion* to the number of those inhabitants in their succeeding generations, and to the duration of their tenancy; which does not appear to be the case, from the terms of the report[3].

4. The *characters* or *indentures* apparent on the surface of the split and broken bones at Kirkdale, and which are appropriated by the hypothesis to *teeth* absolutely, and to *hyænas' teeth* exclusively[4], might have been the effect

[1] "I have one ball of this substance that is in great part invested "with a thin circular case or crust of stalagmite." *Reliq. Diluv.* p. 20, note.

[2] Ibid. p. 49.

[3] The Edinburgh Reviewer of the *Reliq. Diluv.* (p. 208, note,) says: "Since the publication of Mr. Buckland's book, we have been informed "that *Album Græcum* was found in the cave at Kirkdale in a much "greater quantity than had been at first supposed, and was intimately "mixed with the mud in several places." But, if *excrementitious pastes* of recent origin existed there at the time when the diluvial waters entered to occupy the cave during a *whole year,* it is not rash to affirm, that they could not have remained all that time *undissolved* or *unaltered* in their forms; or, have continued *stationary,* during the powerful reaction of those waters in their retreat. Hence, we may securely conclude, that they have been formed since the retreat of the waters; and probably, by the action of the percolating fluid dripping from above.

[4] *Reliquiæ Diluvianæ,* p. 16.

of many very different causes. The crushing of the bones, during the contractile compression of the indurating mineral mass which enclosed them[1], and the *mutual attrition* of their fractured and splintered parts; incipient, progressive, and suspended decomposition, between the time of the first action of the atmospheric air on the osseous fibres, and its final exclusion by the complete incrustation of the stalagmite; these, and various other assignable causes, will have sufficed to furrow the surfaces of the bones, without resorting to the exclusive agency of *teeth*. It is too much, to call upon us, in this period of the world, to acknowledge *equivocal marks* on antediluvian bones found in Yorkshire as *demonstrative evidence of the action of hyænas' teeth;* and to make the *truth of geology* to depend, wholly and absolutely, upon that irreflective acknowledgment.

5. The hypothesis is persuaded, that it has found a *proof* " that animals *lived and died* through successive " generations in the caves in which we find their remains, " nay, even that they *were born* in the same cave"—in " the bones of a *bear* so small that it must have *died im-* " *mediately after its birth,* and, in other bones of indivi- " duals that must have died in *early life,* like the *young* " *hyænas* that have been found at Kirkdale[2]." Now, when we recollect that the *diluvial waters* swept away, at one and the same time, an *entire animal creation of all ages and generations,* if we find the *exuviæ* of the *old,* we shall expect to find also those of the *young;* and then, the remains of an *hyæna cub* in England, or a *bear cub* in Germany, will no more testify their having been *born* in in those countries, or that their parents and progenitors *lived and died* in them, than the remains of a *drowned puppy* on the beach, or in the drain, to which the flux of

[1] See above, p. 114, 115. [2] *Reliquiæ Diluvianæ,* p. 103.

the tide may have carried it. But, we need not go for illustration beyond the hypothesis itself. " In the valley " of the Arno, parts of the skeletons of at least a hundred " *hippopotami* have been discovered. With these are " found also, in great abundance, the remains of *rhino-* " *ceros* and *elephant*, together with those of *horses, oxen,* " several species of *deer, hyæna, bear, tiger, fox, wolf,* " *mastodon, hog, tapir,* and *beaver;* they are from animals " of *all ages,* and one of the elephants *could not have been* " *a week old.* How is it *possible* (asks the hypothesis) to " *explain the general dispersion* of all these remains, *but by* " *admitting; that the elephants, as well as all the other crea-* " *tures whose bones are found buried with them — were all* " *destroyed together by the* WATERS *of the same inunda-* " *tion which produced the deposits of loam and gravel in* " *which they are embedded*[1]*?*" Here then, according to the hypothesis, the exuviæ of a *young elephant not a week old,* in the *Val d'Arno,* mingled with those of elephants of all ages and of *hyænas,* prove only *diluvial destruction.* But, " teeth of *extremely young elephants*" were found also at Kirkdale[2], mixed also with the remains of *older elephants,* and of *hippopotamus, rhinoceros,* three species of *deer, hyæna, bear, tiger, fox, wolf, &c.;* and yet, at *Kirkdale,* the *young elephants* only prove that " *they were* " *dragged in by the hyænas for the purpose of gnawing* " *them;*" whilst, on the other hand, in the *German cave,* the remains of a *young bear that died immediately after its birth, prove that it was* " *born there.*" Thus, *three entirely different causes* are assigned to one and the same simple phenomenon, which *one and the same cause* is amply sufficient, and therefore *most fit,* to explain; viz. *the remains of young animals among old ones, in a confused mixture of discordant genera.* But, the reason for admitting this

[1] *Reliquiæ Diluvianæ,* p. 181—184. [2] Ibid. p. 18.

triplicity of cause is at once apparent, when the hypothesis further asks: " *how is it possible to explain* the " general dispersion of all these remains—but by *admit-* " *ting*, that all the creatures were the *antediluvian inhabit-* " *ants* of the extensive tracts of country over which we " have been tracing them[1]?" for, this *admission* is indispensable for establishing " the *certainty* of the bones " having been *dragged* by beasts of prey into the *small* " *cavern at Kirkdale*[2];" which *certainty* is forthwith assumed absolutely, as if the question defied all replication.

6. It does not appear, from *natural history*, that it is of the nature of hyænas, or of any other beasts of prey, to convey their booty to a *den*, and that always the *same den;* and there to devour, or reserve it. The popular tales of *hyænas' dens*, collected by Busbequius in his oriental travels in the sixteenth century[3], cannot lay claim to much authority in the present expanded and illumined sphere of our natural knowledge. We have heard also of *lions' dens*, from the days of Æsop; of the fearful articles of their furniture, and of the *vestigia*

Omnia adversum spectantia, nulla retrorsum:

and yet, those *lions' dens* do not appear to have ever had any other existence, than in the terrified imaginations of a rude and ignorant age. For, authenticated natural history expressly instructs us, that so far are *lions* from carrying home their prey *to eat it in a den*, that they devour it ravenously on the spot where they seize it, or in the nearest covert, if disturbed by the presence of man; *leaving behind them what they do not at the time consume, and regardless of what may become of it as soon as they have satisfied the present cravings of their hunger.* On which account the natives of South Africa, at the present

[1] *Reliquiæ Diluvianæ*, p. 184. [2] Ibid. p. 96. in fin. [3] Ibid. p. 22.

day, are accustomed to procure a considerable part of their animal food from the *remnants* thus abandoned on the ground " by lions and *other carnivorous animals*[1];" and therefore, assuredly, by *hyænas also*, which are well known to constitute one of the most active tribes of those African depredators. And, if they are so little provident while prey is abundant, we may be certain, that when it becomes scarce, and hunger proportionably quickened, it would be the more eagerly devoured on the spot where it was caught; nor have we any good ground for supposing food *carried home* at any time by carnivorous animals in a state of wild freedom, except during the *tender age of a young brood*[2]. From hence, therefore, we may reasonably and philosophically conclude; that the *hyænas' den* of the hypothesis, had never any more relation to reality and fact, than the *lions' den* of ancient Æsop. And, though we are told, that " hyænas are greedy of putrid flesh and " bones, like dogs[3];" yet we may be well assured, that, like dogs and lions, it is only in the defect of fresh and blood-full game, of which the hypothesis assumes, that

[1] " This is the part of Africa, extending S. and S.E., to which the game " migrate in the winter from the more northern latitudes, and here they " remain about four months. The months are called the *Bushman's* " *harvest*, from the great numbers of animals they obtain during that " season. They are seldom at the trouble to hunt them themselves; *the* " *game killed in the night by lions and other carnivorous animals being so* " *great that abundance is left for the Bushmen.* They are accustomed to " dry the flesh until it is so hard that it can be reduced to powder, in " which state they preserve it till times of scarcity. This was the only " instance of prudent economy I had met with among the nation. It " appeared to be forced upon them, from *the quantity of game thrown in* " *their way during this period of the year.*" *Travels to S. Africa. Second Journey.* By the Rev. JOHN CAMPBELL. Vol. ii. p. 19, 20. But, according to the natural history of the *hypothesis*, all this quantity of game *ought* to have been *dragged into dens.*

[2] Nahum, ii. 12, 13.

[3] *Reliquiæ Diluvianæ*, p. 21.

there was a rich abundance " in the immediate vicinity " of the den at Kirkdale[1]."

One instinct of Busbequius' " *modern hyænas*" is deserving of attention, they heaped up their bones at the *outside*—*juxta*—and " *around*[2]," their dens. This practice, presents a striking contrast with the supposed habits of the *obsolete hyænas* of Yorkshire, which lived contentedly with many thousand fragments of bones loading and littering their den, and choking up the channel that formed " their constant gangway[3];" and which occupied the den precisely " during the period that the stalactite " and stalagmite *were still forming* (that is, whilst the " water was *still dripping* from the roof and down the " sides upon the floor,) so that their constant passage in " so *low a cave* would much *interrupt* this deposition, " as they would *strike off* the former from the roof and " sides by their *constant ingress and egress*[4]:" that is, (since, to *interrupt the deposition*, signifies only, *to cause the water to continue dripping*,) their feet would be always in *slop*, and their hides always *soaking*: and yet, the hypothesis insists, that " to animals of *such a class*, our cave " at Kirkdale would afford *a most convenient habitation*[5]." The hypothesis indeed affirms, that the *outside bones* of the antediluvian hyænas' den at Kirkdale were " swept " far away, and scattered by the violence of the diluvial " waters[6]," and therefore, *they cannot possibly now be shewn*; but, it only becomes the *more necessary*, that it should *shew us the inside bones of the dens of modern hyænas*.

7. The reflective and tardy operation of *separating bony pieces from the carcase of a large animal*, in order to

[1] *Reliquiæ Diluvianæ*, p. 40.

[2] Ibid. p. 22, "*juxta* quam videre est ingentem cumulum ossium."

[3] Ibid. p. 49. [4] Ibid. p. 48. [5] Ibid. p. 24. [6] Ibid. p. 39.

convey them through a small orifice, either by individual labour or "acting conjointly with others[1];" which the hypothesis finds it indispensably necessary to attribute to the Kirkdale hyænas, in order to account for "broken and "splintered fragments of the *larger* animals, elephant, "rhinoceros, &c. being found co-extensively with the "rest in the *inmost and smallest recesses*[2]," and without the establishment of which *fundamental fact* the hypothesis must irretrievably fall to pieces; does not any where appear, from natural history, to be one among the instincts with which the Creator has endowed the ravenous *hyæna,* or any other voracious quadruped. The σπλαγχνα πασαντο, indeed, pertains to them; but the μιστυλλον τ' αρα τ' αλλα[3], we have good reason to believe does not pertain to them, but, remains peculiar to the *lanionian* and *coquine* arts among mankind. And I leave it for consideration, whether the slightest ground has been established for entertaining a supposition, that *antediluvian hyænas* were essentially distinguished in their instincts, from what the hypothesis very warily denominates "*modern hyænas.*"

8. It is impossible not to be sensible of the extreme *rapidity of hypothetical progress,* where a specific and exclusive cause is thus, without hesitation, assigned to the fractured and splintered state of the bones at Kirkdale, as if by an eye-witness of the operation: "Not one skull, and

[1] "Though an hyæna would neither have had strength to kill a living "elephant or rhinoceros, or to drag home the entire carcase of a dead "one, yet he *could* carry away *piecemeal,* or acting conjointly with others, "*fragments* of the most bulky animals that died in the course of nature, "and *thus* introduce them into the inmost recesses of their den." *Reliq. Diluv.* p. 37.

[2] Ibid. p. 16.

[3] "They *eat the entrails*—and *cut the rest into small pieces.*" Hom. Il. i. 464.

" few, if any, of the larger bones, are found entire; *for,* " *they had all been broken up by the hyænas to extract the* " *brains and marrow*[1]." How much is not the *reason* constrained to demand, before it can possibly consent to receive this minute report from the *imagination,* as authentic and *availably historical?*

9. The pains which the hypothesis takes to make it appear; not only that the hyænas eat all the various animals, but that they also *eat one another;* " that they were " occasionally killed and devoured by the stronger indi- " viduals of *their own species,* and that both young and " old were *always eaten up after natural death*[2];" although " elephant, rhinoceros, hippopotamus, horse, ox, and " three species of deer, hare, and rabbit[3],—lived not far " from the spot," indeed " in the immediate vicinity of " the den[4]," and although the hypothesis acknowledges, that " we have *no positive evidence* that it is the habit " of *modern hyænas* to devour their own species[5];" that they sometimes eat *parts of themselves*[6]; that the remains of the *last survivors are now missing* at Kirkdale, *because* they " rushed out of *the den,* and fled for safety to the " hills, on the rise of the diluvial waters[7];" and, that the *sole cause* of the *perfect state* of the bones of an hyæna detected at Lawford was, that it was the *last individual of the " extirpated race,"* and therefore " *could have had no* " *survivors to devour its bones*[8];" appear to confirm so sensibly the character which I have alleged, of a *forced proof,* when the *foundation of the hypothesis* is duly considered, that I am sure I shall be justified to the reader in abstaining from any attempt to resist these particular allegations.

[1] *Reliquiæ Diluvianæ,* p. 101, note.
[2] Ibid. p. 30.
[3] Ibid. p. 15.
[4] Ibid. p. 40.
[5] Ibid. p. 27, 28.
[6] Ibid. *ib.*
[7] Ibid. p. 38.
[8] Ibid. p. 27.

But, that which constitutes the most weighty and really important objection to this ingeniously inventive *hypothesis*, is its direct contradiction of the philosophical conclusions to which the principles of the *Mosaical Geology*, closely and uninterruptedly pursued *from the beginning*, have gradually and *eventually* conducted us; whilst, at the same time, it is unprovided with any *counter-principles* deduced from that or from any other geology, of equal extent, or of virtue to invalidate or in any degree to affect those conclusions: laying no deeper foundation for its support, than the superficies of present and sensible phenomena. It does not trace those phenomena, *pedetentim et gradatim*, up to the first, originating, and substantiating principles generative of them, but is contented to take them up, as it were, *by the way;* and seems to be deterred by a pious, but excessive scruple and awe of the subject, and by a self-unjust diffidence and forbearance, from encountering the imaginary difficulties of adventuring to *ascend to those principles*[1]: making no experiment of the simplicity of the course, and of the facility of the operation, by which the end is to be attained. By which unfortunate avoidance, it abandons that which is, in truth, the *fundamental groundwork of the whole argument;* leaving it open and undefended, and, by necessary remote consequence, the mineral geology in free and undisturbed possession of its mendacious *chaos*, and its meretricious *nature:* as has been abundantly exemplified[2]. It is not therefore *indifferent* or *equal* in the consequences, whether the argument of *diluvial revolution* be grounded on the *hyænas' den and sensible phenomena*, or on the *transport of bodies and moral evidence;* because, if we rest it only on the *former*, we are still left to perceive *beyond it* an ex-

[1] *Vindiciæ Geologicæ*, p. 33.

[2] See above, vol. i. Part I.

tensive impenetrable distance of *obscurity* and *uncertainty*, in which we are unable to make our way, and which perpetually provokes our solicitude and perplexes us with inquiries and doubts; whereas, no sooner do we establish it on the *latter*, than all that distance becomes at once cleared and opened to our view, and we are able to trace its whole extent, *pedetentim et gradatim*, up to the very *Source of all light*, and the *Origin of all being*. Thus, not only the *hypothesis* is attended with its own peculiar difficulties, which are absolutely insurmountable; but, if it were otherwise, it would still leave the great *foundation of divine historical revelation* in darkness and perplexity. The *Reliquiæ Diluvianæ* has, indeed, ably and unanswerably added to the demonstrations of the truth of the *sacred history of a deluge;* not by hypotheses of *hyænas' dens* or *bears' dens*, but, by its sagacious discrimination between *alluvial* and *diluvial* productions, duly limiting the operation of the former, and vindicating to the latter its own proper and exclusive effects[1]; and, by its inforcement of the amazing "*proofs of inundation at* "*high levels*[2]." But, when we have ascertained *the truth*

[1] *Reliquiæ Diluvianæ*, p. 185, &c.

[2] Ibid. p. 221, &c. To the proofs there adduced from Humboldt, of *extinct terrestrial* animals, found at an elevation of more than 7000 feet above the sea, I shall add the following statement of a *marine* animal, from the *Travels to the North Cape*, of the enterprising and scrupulous inquirer, Captain De Capell Brooke. "Looking to the right, the prodigious "mountain of Sandhorn towered close above me. Its height exceeds "3,000 feet. What appears very extraordinary, is the well-authenti-"cated fact of the *skeleton of a whale*, which lies, and probably has lain "for ages, on the very summit, at so great a height. In what way can "we pretend to explain so singular a phenomenon? Was it deposited "there in the time of the deluge, or in subsequent ages? If the latter, "how happens it that we have remained ignorant of this second inunda-"tion; which, at the height the waters must have reached, not alone

and consistency of the sacred historian in his relation of the event of *an universal deluge,* we are only, and with reason, the more eagerly stimulated to *seek the same evidence* in his history of every thing which *preceded that event,* up to the great incipient epocha when "*God* CREATED *the heaven and* "*the earth;*" and we do not (or should not) remain satisfied with the *partial discovery* of the one; since it is probable, that those two great master-works of the same divine hand, bear *intimate and essential relations to each other.*

It is by accompanying this most veracious historian in every stage of his history *of that great* FIRST EPOCHA, by combining it with his *history of the universal deluge* and *destruction of the former earth,* and by comparing both these with the *actual phenomena of the globe,* that we have seen the most powerful moral evidences conspire to substantiate the *transport* of the dead bodies of a former animal creation from the *tropics* towards the *poles;* but, we have not discovered a single moral evidence tending, in any degree, to support or countenance the supposition which the hypothesis demands for its subsistence, that *animal genera,* whose natures now confine them *within the tropics,* were at any former period *living inhabitants of the north of Europe;* or, to give even a colour of truth to the purely imaginative conception *on which that supposition must ultimately rest,* that the *relations of the sun and of the circles of the earth* have ever so much varied from those which

"from the above circumstance, but from other marine remains, and the "general marks of the sea in equally high situations, would have covered "nearly the whole of the habitable world, and overwhelmed the race of "man? Or, if we could suppose the former, how wonderful does it "appear to us, that these bones should have lain whitening in the blast, "on the top of Sandhorn, ever since the deluge, a period of more than "4,000 years!" pp. 236, 237. Of this amazing monument we may hope to obtain tangible evidence, through the active offices of the same judicious traveller.

they now maintain, as to have once produced the *climate of the torrid zone* in the *polar vicinities of the temperate.* Amidst the inextricable difficulties in which the mineral geology has entangled itself, by concluding from inadequate investigation, that animals *must* once have been the *inhabitants* of the countries in which their *fossil remains are now found;* the eminent Cuvier, as in despair at finding himself deserted both by *evidence* and *experience* on this question, strives to break through them all; and propounds, with theoretical intrepidity, that there *once* were species of elephants, rhinoceri, &c., adapted by their *natures* to the *northern* regions, as there are now to the *equatorial.* But, since the *mere presence of the exuviæ* is utterly incompetent to *legitimate* any such conclusion, and, since the testimony they can afford must be determined by *prior testimony;* Cuvier's proposition, is reduced to a *simple and gratuitous verbal assertion.* The scientific author of the *Reliquiæ Diluvianæ,* with a more chastened invention, inclines to think; that the *climate* in which those animals *lived,* must necessarily have had a temperature corresponding to that which our *experience* instructs us has been provided, by the Author of nature, for the nurture of animals of *those genera* " which at present exist *only in tropical climates,* " and chiefly south of the equator[1];" and of which, " the " *modern hyæna* is an inhabitant exclusively of *hot cli-* " *mates*[2];" and he therefore justly concludes, " that it is " *more probable* that the *climate was warm* in which those " animals lived and died, than that a *change of constitu-* " *tion* should have taken place in so many animal ge- " nera[3]." But then, he goes on further to conclude; " that a *change of climate in the northern hemisphere*[4]—

[1] *Reliquiæ Diluvianæ,* p. 44.
[2] Ibid. p. 21.
[3] Ibid. p. 45.
[4] Ibid. p. 162.

" which was probably *warmer before the deluge*[1]—seems " *to follow from that circumstance.*" Thus, these two scientific writers diverge from each other in opinion upon this important question, just as far as from the equator to the pole.

In truth; the great *fundamental point* at issue, between the argument maintained in the preceding treatise, and that advocated by the eminent author of the hypothesis of the *hyænas' den*, will be found to resolve itself, absolutely, into this *one ultimate question:*—Whether the *moveable exuviæ* of tropical animals have at any period *been removed from the equator towards the pole*, by an agent pertaining to this globe and operating universally over its superficies? —or, Whether the *exuviæ* have always been stationary in the polar vicinity, and *the sun's vertical power been removed from the polar latitudes to the equatorial*, leaving the *exuviæ* in a climate unnatural to their living bodies? That is,—Whether *the exuviæ went to a polar climate*, or a *polar climate has come to the exuviæ?* one or other of which events must necessarily have taken place, and the main question between us is, *which* of the two *really did take place?*

This final and determining question, I must frankly confess, appears to my judgment, after maturely weighing every argument on each side, to resemble very closely the question, " *Whether Mahomet went to the mountain,*" or " *Whether the mountain came to Mahomet?*" and, the hypothesis appears to me to decide in favour of the latter, not on account of the superior reasonableness or probability of the thing, but, because it quadrates better with *some system previously adopted.* This alteration of climate *from a greater to a less degree of warmth*, which imagina-

[1] *Reliquiæ Diluvianæ, index*, p. 285.

tion has engendered in order to render the northern latitudes congenial at some former period to hyænas, lions, elephants, hippopotami, &c., has been ascribed to very different causes; let us hear Buffon upon this subject[1].

"It is of *absolute necessity*," says he, "*de nécessité* "*absolue*—that the species, whose *exuviæ* are *found* in "northern latitudes, *must* formerly have *there existed, sub-* "*sisted*, and *multiplied*, as they exist, subsist, and multiply "at the present day in southern countries." Upon this unskilful conclusion he founds an inquiry,—Whether there is *any cause* which may have so changed the temperature of the different parts of the globe, as to render it possible that the northern lands, which are now subject to extreme degrees of *cold*, may formerly have experienced a degree of *warmth* now found only between the tropics, and therefore suited to the animal *genera* which now exist only within them? "Some philosophers," says he, "may have thought, that this effect might have been "produced by a change in the obliquity of the ecliptic; "on which calculation it would seem, that 360,000 years "ago, the present latitude of Siberia, which is *sixty* de- "grees north, was only *fifteen* degrees, which is at present "the latitude of India; and that elephants then inhabited "the former, as their congenial latitude, as they now do "the latter." This supposition Buffon asserts to be absolutely unmaintainable; "because," says he, "the change "of obliquity in the ecliptic is not constantly progressive, "but limited and vacillatory, and could *never* have pro- "duced such a variation as is here contemplated." He therefore conceived, that the *loss of warmth* in northern latitudes, (the *cause of which loss* is made the problem to be solved,) could not have been the consequence of any

[1] *Théorie de la Terre*, tom. vi. 4to.

change in the *relations of the sun and the earth;* and, that it could only have resulted from the cause assigned in his own paradoxical hypothesis; viz. that our earth was originally *a piece of the sun's substance,* which was struck off from its orb by the violent collision of a passing comet; and was driven into space in a state of *red-hot fusion,* where it gradually *lost its native heat:* that, in process of time, the latitude of Siberia became *sufficiently cooled* for elephants, &c., to live, subsist, and multiply there: that, when Siberia became at length *too cold* for them, they migrated to the *southward;* until they ultimately became *confined to the torrid zone,* which alone now affords the warmth requisite to their natures. He makes no inquiry at the same time, *how* elephants came into existence coincidentally with the moment that his *hot earth* became *cool enough* to receive them in the *north;* nor does he take any account of the *diminution of warmth,* which, according to his own hypothesis, must have progressively been taking place in the torrid zone, tending to render even that zone too cold for their natures.

The eminent author of the hypothesis of the hyænas' den, cautiously abstains from committing himself by any opinion "*what the cause of that (supposed) change of* "*climate was;*—whether a change in the inclination of "the earth's axis, or the near approach of a comet, or "any other cause or combination of causes purely astro-"nomical[1];" nevertheless, he testifies a decided opinion, that the *presence* of the remains of tropical animals at Kirkdale, *proves* that they were antediluvian inhabitants of Britain; and, from that circumstance, "it *seems to him to* "*follow,* that a change of climate has taken place in the "northern latitudes, *which were probably warmer before* "*the deluge*[2]." He is sensible, indeed, of the necessity

[1] *Reliq. Diluv.* p. 47. [2] Ibid. p. 162. *Index,* p. 285.

of relinquishing all *practical reasoning from overt causes* to obtain that change of climate, and he therefore takes refuge, *theoretically, in an occult one:* "one thing, how-"ever, (says he,) is *nearly certain*, viz. that *if* any change "of climate has taken place, it took place *suddenly*[1]." This *suddenness* of change, will be found congenerous with the *hypothetical ground* out of which it springs.

Unfortunately for the theories of all such ingenious hypotheses as would either explain the manner, or assume the fact, of the climates of Siberia, or Yorkshire, having *become colder* than they were before the deluge, and therefore no longer fitted for the accommodation of the animals which have been above enumerated; that is, of their having *lost a temperature*, which is now exclusively *found in the tropical latitudes;* the *evidence of fact* bears directly against them all, by establishing the certainty: that those latitudes, instead of having become *progressively colder*, have grown *progressively warmer;* that, instead of warmth *departing from them*, warmth has been gradually *advancing towards them*, during all the ages of which *history* has preserved for us any testimony; which *testimony*, has a retrospective effect on the *preceding ages* also, at least as far as to the *period of the deluge*. It is that fact, asserted and supported by the Honourable Daines Barrington, in 1768[2]; "that the seasons have become infinitely "*more mild* in the northern latitudes than they were six-"teen or seventeen centuries ago,"—"that Europe is "become *warmer than formerly*[3]," as he is echoed by Hume; which has stimulated philosophical inquirers to investigate the cause of this *extension of warmth towards the north*. Amongst those inquirers, the most laborious was the Abbé Mann; who, in a memoir published in the

[1] *Reliquiæ Diluvianæ*, p. 47.

[2] *Philosophical Transactions for Jan.* 18, 1768. [3] *Essay XI.*

Transactions of the Electoral Academy of Manheim, in 1789, and afterwards at Bruxelles in a *Collection of his Memoirs,* is brought by an accumulation of testimonies to this conclusion: "that it appears incontestable, that the "soil and temperature of all the countries from Spain to "the Indies, and from Mount Atlas to Lapland and the "extremity of the north, have been entirely changed "during the course of ages, from the earliest period of "the historical monuments which we possess to the "present time, *by gradually passing from extreme hu-* "*midity and cold to a great degree of dryness and* "*warmth*[1]; that is to say, from one opposite to another."

This progressive *exhausture of humidity* from the present earth, and the consequent *diminution of cold* in the temperature of the air of northern latitudes, was indeed a necessary consequence of the *progressive exsiccation* of the earth from the state of a *sea-bed,* which it originally was. But if we suppose, with the hypothesis, that it was *not a sea-bed,* but the former *antediluvian surface of the earth* which was overflowed by the diluvial waters for the space of *twelve months;* although the moisture it would have imbibed during that period might, for a short time, have caused a greater degree of cold in the temperature of its air than was natural to it before the inundation, yet, the temperature it would eventually *recover by its desiccation,* would only *balance* that which it had *possessed before its*

[1] "Il paroît donc incontestable, que le terroir et la température de "tous les pays, depuis l'Espagne jusqu'aux Indes, et depuis le mont "Atlas jusqu'à la Laponie et au fond du Nord, ont changé entièrement "dans la suite des siècles, depuis les premiers monumens historiques "que nous en avons, jusqu'à présent, en s'acheminant graduellement "d'une extrême humidité et froid, vers une grande sécheresse et chaleur; "c'est-à-dire, de l'une opposée à l'autre." *Mémoires sur les grandes Gélées, et leurs Effets.* Mem. i. p. 12. Par M. L'Abbé Mann.

humectation; and, no greater degree of warmth could be philosophically inferred for the latter period. For, we have absolutely no ground whatever, either in science, history, or revelation, for supposing, that any *change* has taken place in the laws and disposition of the *causes which were originally ordained to produce warmth upon the earth;* the same causes, therefore, would have produced only the same degree of warmth before the humectation of the earth, as after its entire desiccation. And it would be a great inconsistency, to urge the *presence of the remains* of animals whose *genera* we see restricted to the *tropics,* in proof of a derangement of the *solar relations of the earth;* or, of a greater degree of warmth (much more of a tropical warmth) in northern latitudes; after having once admitted, "that the earth has been subjected to an *universal inun-* "*dation which swept over every part of the globe*[1], and "after having also admitted, that elephants, hippopotami, "rhinoceri, mastodon, hyæna, tiger, &c. *have actually been* "*drifted by its waters*[2]." For, if it swept over *every part of the globe,* it must have swept as far as *from the tropics to the latitudes of Yorkshire and of Franconia,* which distance is not a sixth part of that universal surface; and, there is no philosophical reason which can *limit the extent* of its operation, short of *demonstrated impossibility:* the *contrary* to which *impossibility,* has already been *demonstrated*[3]. Thus, to whatever period we carry back our thoughts *into time,* with reason, experience, and sound philosophy, we find the climate of Siberia, or Yorkshire, equally unadapted, as at the present day, for elephants, hyænas, &c. to have *existed, subsisted,* and *multiplied* in them, that is, to have *lived* in them; and, therefore, this discovery becomes collateral demonstration, that the animals whose

[1] *Reliquiæ Diluvianæ,* p. 224. [2] Ibid. p. 183, 184.
[3] See above, p. 90—93.

remains are found in them did not arrive there in a state of *life*, but of *death*, and therefore, at the period, and by the means, which we have been enabled to investigate and assign.

The causes of the very peculiar interest which the recent discovery of the *Cave of Kirkdale* has excited amongst us, are chiefly these two: *first*, that the public attention was never before so generally attracted amongst us to a subject of this nature, as it has been by the interesting researches, the ingenious conjectures, the graphical descriptions, and the masterly style, of the eloquent and distinguished Professor of Mineralogy: *secondly*, that it had not been generally known, or at least noticed amongst us, that similar assemblages of animal remains had already been discovered, in the Continent of Europe. It is some years, since M. Cuvier first published his observations "*on the bones of a species* "*of bear*" (and other animals) "*which are found in* "*certain caverns of Germany and Hungary*[1]." Of those bones he reports, that three-fourths were those of an extinct species of *bear;* of the remaining fourth, two thirds were those of *hyænas*, and one third of *wolf, fox, tiger* or *lion*, &c.; but, it is especially noticed, that scarcely a bone of *elephant* or other *graminivorous* animal was found among them. Now, the difference between these *animal associations* and those at Kirkdale, affords a sufficient indication, after all that we have been contemplating, that all the *associations* were as *fortuitous* as those

[1] "*Sur les Ossemens d'un Genre de l'Ours, &c. qui se trouvent dans* "*certaines Cavernes d'Allemagne et de Hongrie.*" This curious Tract, revised, and enlarged by the insertion of an abstract of Mr. Professor Buckland's Paper on the Kirkdale Cave in the *Philosoph. Trans. for* 1822, forms a chapter in the 4th volume of the *Ossemens Fossiles*, p. 291, entitled, "*Des Cavernes où les Ossemens de Carnassiers sont accumulés en* "*grand nombre.*" I refer to the *New Edition* in 4to, 1823.

admitted to be such by the hypothesis in the Val d'Arno; and it, therefore, shews the precipitancy and insecurity of inferring, positively, from the individual case of the *Kirkdale cave*, that its *elephants* could only have become mingled with its *hyænas* from the *former* animals having constituted an article of the *food* of the *latter*. Assuredly, the same vast mechanical cause which propelled, to what is now Germany and Hungary, the floating and accidentally coalescing carcases of *hyænas, bears,* and *wolves,* or, which propelled to what is now the Val d'Arno, those of *hyænas, mastodon,* and *deer,* might have propelled, to what is now Yorkshire, the floating and accidentally coalescing carcases of *hyænas, rhinoceri,* and *elephants;* nor will the presence or the absence of *graminivora* among *carnivora,* tend in the smallest degree to alter or affect the conclusion. The hypothesis, would repel this last proposition by a very insufficient argument: it insists, that the extreme rarity of *elephant, rhinoceros,* and all the *ruminantia* or *rodentia* in most of the *bears' caves,* while at the same time they contain *hyæna, tiger* or *lion*[1], *wolf,* and *fox,* " (in which respect they differ materially from the cave " of Yorkshire,) is *a variation consistent with the different* " *habits of bears and hyænas,* arising from the different " structure of their teeth and general organisation; from " which it *follows,* that bears prefer *vegetable* to *animal* " food; and, when driven to the latter, prefer sucking " the blood to eating the flesh, whilst hyænas are beyond " all other beasts *addicted to eating bones*[2]." But, the preference which *bears* may give to vegetable food before animal, or to blood before flesh, cannot tend to explain their *consociation in the same cave* with *hyæna, tiger* or *lion, wolf,* and *fox*. Nor, can it be accounted for by their " *habits;*" for, as the hypothesis itself contends, on

[1] *Ossemens Fossiles,* tom. iv. p. 304. [2] *Reliq. Diluv.* p. 105.

another occasion,—" *we can imagine no circumstance that* " *would collect together, spontaneously, animals of such* " *dissimilar habits, as hyænas, tigers, bears, wolves,* " *foxes, &c.*[1]" *Fortuitous concourse,* therefore, as in the *Val d'Arno,* is the only explanation that the mind, unfettered by hypothesis, will or can admit, either for the associations at *Gailenreuth* or for those at *Kirkdale.* And, indeed, the ingenious author is himself brought to *hesitate,* with respect to the few graminivorous animals which have been found in the German caves, when he thus *grants us our choice:* " they *may either* have been *washed in* together with " the *diluvial* loam and pebbles, *or* have been *dragged in* " for prey by the few *hyænas* that occasionally *intruded*[2]." I shall not hesitate to accept the *former.*

Of the caverns discovered in Germany and Hungary, M. Cuvier affirms; " that the bones are nearly in the " same state in all the caverns; detached, scattered, and " partly broken, but never *rolled,* (or *triturated,*) and that " they have, *consequently,* not been brought from a " distance *by the waters*—mais jamais *roulés,* et *par con-* " *séquent* non amenés de loin *par les eaux*[3]." He here entirely forgets, that water can *convey on its surface,* as well as *drive along the bottom of its channel,* and, that bodies can be moved *before,* as well as *after* they are reduced to skeletons; a difference, which has not escaped the sagacity of the respected author of the hypothesis; and he, therefore, thus incautiously argues and concludes from the phenomena: " It is scarcely *possible to imagine* " any other than the *three* following general causes, that " can have placed these bones, in such great quantity, in " these caverns: *viz.* either, 1. that they are the remains " of animals that *inhabited* these dwellings, and died

[1] *Reliq. Diluv.* p. 39.
[2] Ibid. p. 106.
[3] *Ossemens Fossiles,* tom. iv. p. 303.

" peaceably within them: or, 2. that *inundations*, or " other violent causes, brought them thither: or, 3. that " they were *enveloped in the stony strata whose dissolution* " *produced the caverns*, and that they have not been " themselves dissolved by the agent that carried away " the matter of those strata—ou bien enfin, ils étoient " *enveloppés dans les couches pierreuses dont la dissolu-* " *tion a produit ces cavernes*, et il n'ont point été dissous " par l'agent qui *enlevoit la matière des couches*[1]." This great and pre-eminent naturalist, is sometimes either not very minute in his own apprehensions, or not very clear in the terms in which he would convey them to his reader. In the case last stated, it is manifest to every understanding; that, if the bodies *were enveloped* at any period in that which is now a *stony stratum*, the stratum must have been *soft* at the time of their *envelopment*, and their *own bulks* must have originally *produced the cavities* in which they lie; as *plums enveloped* in the dough of a pudding, unquestionably *produce their own cavities:* but, if the cavities were *produced* only by the *dissolution of the interior of a solid stratum*, and by the expulsion of a stony substance that once *filled those cavities*, then it is equally manifest, that *the bodies could never have been enveloped in it.*

" The *third* and *last* cause," proceeds Cuvier, " is " *refuted* by the circumstance, that *the strata* in which " the caverns occur contain *no bones.* The *second*, is " *refuted* by the preservation of the smallest processes of " the bones, which forbids the supposition that they have " been *rolled.* We are, therefore, *obliged* to return from " these to the *first* cause, *whatever difficulties may attend* " *it*—on est donc *obligé* d'en revenir à la première, " *quelques difficultés qu'elle présente de son côté.*" And thus it is that he arrives at his *conclusion*, " that the

[1] *Ossemens Fossiles*, p. 306.

" establishment of these animals in the caverns, *was* " *therefore long subsequent to the epocha when the stony* " *strata were formed:*" a complicated proposition, which, as we have seen, requires to be disentangled; for, although the establishment of the animals in their *cavities* must indeed have been *subsequent to the epocha when the limestone paste was formed in the basin of the sea,* yet, they might have been established in them *before the induration of that paste by the departure of the sea;* which departure alone, has rendered *stony* the *strata* in which we now find them.

To answer M. Cuvier, according to this reversed order of his causes, I have simply to observe, 1. With respect to what he calls the *last* cause: that the case of a compound mass of bodies, mutually coalescing, floated and driven from a vast distance on the *surface* of water, and *simultaneously* immersed in a loose homogeneous soil *in which were no bones,* totally destroys the grounds on which he imagines that he has refuted it; and, there could be no reason to expect to find *bones of an earlier date* in the soils in which those transported bodies were then deposited, nor can we imagine the *transport* of bones otherwise than in a *buoyant carcase,* since detached bones, like stones, would sink to the bottom. 2. With respect to his *second* cause, I have to observe: that the immersion of the bodies *whilst inclosed in their integuments,* and the speedy *departure of the sea from the soils into which they were immersed,* totally destroys also the ground upon which he would refute that cause: And therefore, that these *two causes,* which he thus first adduces and then rejects, are, in fact, the *true cooperating causes* which have produced all the phenomena. Whereas, 3. with respect to his *first* cause, which alone he admits as the *true one;* the invincible and triumphant objections which have been shewn to oppose it, refute it altogether.

The truth is, that the Mineral Geology, having never

been able, by the penetration of its own unassisted discernment, to perceive or "imagine" the possibility of a case in which a *compound mass of bodies* could have been acted upon by water, with respect to transport and deposition, exactly in the same manner as an *individual body*, never dreamt of assigning a common cause to effects between which it had recognised no analogy; and aspiring, nevertheless, to guide and instruct others, it rambled into all the by-ways of speculation, until it implicated itself in a labyrinth from which it has never been able to extricate its course. But, a cautious and reflective application of the lights administered to us from a brighter source, to the effects which are distinctly subjected to our examination, will entirely satisfy our reason; that the same cause that floated from a southern latitude the *solitary alligator* found imbedded within a limestone rock in Dorsetshire, floated also from the same quarter the *consociated elephants, hyænas, &c.*, found inhumed within a limestone rock in Yorkshire or Somersetshire; and, that the same operation that kneaded *shells* into the limestone masses of Portland, plunged also both the *individual* and the *compound body* into the several *limestone pastes* in whose *indurated substance* they have at length been discovered.

The case will be found to stand the same with respect to the hypothesis of the *hyænas' den at Kirkdale*, as to that of Cuvier's *dens in Germany;* which latter naturalist, as will be expected from his own solution of the problem, entirely coincides with the former inventive hypothesis[1]. "The animals did not enter into the cavern

[1] "Il est *suffisamment prouvé* que ces divers animaux ont *vécu* en-"semble dans les mêmes pays—ce fait important me paroît avoir été "*parfaitement établi* par M. Buckland." *Ossemens Foss.* tom. iv. p. 305. M. Cuvier, however, differs from Mr. Professor Buckland, on the cause of the *polish* which appears on the upper surfaces of some of the bones. The latter, "can imagine no other means than the *repeated touch of the*

" *spontaneously,*" says its sanguine and animated author, " nor fly into it *for refuge;* for, the *diameter* of the cave, " compared with the *bulk* of the elephant and rhinoceros, " renders this solution *impossible;*" and, for the same reason, " *entire carcases* of those large animals could not have " been drifted into the cave[1]." Both these positions have been freely and amply granted. " Had they been drifted " *after* the flesh was separated, they would have been " at least slightly *rolled* on their passage." This position also, has been as freely granted. " But, the cave could " not have *contained* a twentieth part of the smaller " animals whose *exuviæ* are found; besides, it still re- " mains to be shewn, *by what means the skeletons were* " *split and broken to pieces*[2]." The *concentrating weight* and *contractile force* of the limestone while drying, settling, and consolidating its substance, appears completely to account, at once, both for the *narrow space into which the multitudinous exuviæ have become compressed,* and for the necessary consequence of the bones, previously fractured in their transport, being more extensively and variously " *split and broken to pieces:*" " scarcely a single bone," says the author, " has escaped fracture, with the excep- " tion of the *astragalus,* and other hard and *solid* bones of " the *tarsus* and *carpus joints,* and those of the feet[3]." The same effect is accounted for in the same manner by Cuvier, in the fossil remains found in the *close and solid strata* of Paris: " They are either entire or broken, *according to the greater or less* " *resistance which they*

" *living hyænas' feet and skin.*" (p. 32.) The former thinks, " that it " can only prove that some *current of water* has passed over them, " and in the cavity where they lie." (*Oss. Foss.* ibid. p. 306.) I confess, that the latter appears to me the more probable cause; unless the *continued dropping of the water from the roof* should have produced the effect, which I incline to consider as still more probable.

[1] *Reliquiæ Diluvianæ,* p. 39, 40. [2] Ibid. p. 40. [3] Ibid. p. 16.

" *have opposed to the pressure of the* (indurating) *strata* " *that weighed upon them*[1]. Thus, the bones of the *carpus* " and *tarsus*, the interior of which is *solid*, are gene- " rally entire.—The bones of the thighs, legs, and *all the* " *long and hollow bones*, especially of the *larger animals*, " have no part entire except the *solid extremities*:—the " heads are generally crushed and compressed, or *only* " *half of them remaining*." And yet, let it be remembered, without the agency of " *hyænas to break them up, in order* " *to extract the brains and marrow*[2]."

That none of those bones should be found *incorporated* into the sides or roof of the cave; that is, *into the substance of the limestone;* and therefore, that they should " have *no further connexion with the rocks themselves* " *than that arising from the accident of their being* " *lodged in the cavities*[3];" results, in course, from two obvious causes already exposed: 1. that all the skeletons, though dislocated and shattered, were strongly *incased in their hides;* which strong *incasements*, would both have *separated the bones* from all contact with the loose matter of the limestone, and would, at the same time, have tended by their pliancy to multiply the *compressive compound fracture* of their contents, in proportion to the induration of the mass: and 2. that the *calcareous matter*, in uniting and condensing its own *homogeneous particles* during the process of *dessication*, would, in the same degree, have detached itself from those *foreign surfaces*, which would have decayed gradually as the limestone indurated: and, if any of the descending waters of the mass flowed into these cavities, their progress through them would have operated to increase still more the *sepa-*

[1] " Ils y sont entiers, ou *cassés*, selon le *plus ou moins de résistance* " *qu'ils ont opposée à la pression des couches qui ont pesé sur eux*," &c. *Ossemens Fossiles*, tom. ii. p. 234.

[2] See above, p. 301.

[3] *Reliq. Diluv.* p. 9, 10.

ration between the mineral and the animal matter. The author "*states*, that the cave *was not produced by the pre-* "*sence* of the animals whose bones we now find in it[1];" but, this is a gratuitous statement, unsupported, and founded wholly upon a pre-assumption, that "the animals "were lodged in the cavity *at a period long subsequent to* "*the formation and consolidation of the strata in which the* "*cavity occurs*[2]:" thus *confounding*, like Cuvier, the *distinct successive stages* in the formation of the rock; and overstepping the inquiry, whether they might not have entered the limestone during its *pristine fluid state*, in which state it undeniably incorporated into its substance the enormous quantities of *marine bodies* contained in its present consolidated mass, which bodies as undeniably "*produced* in it, "by their *presence*, their own *cavities*." With respect to the remaining difficulty, "the disproportion between the num- "ber of *teeth* and *bones* now remaining;" the known fact, that bones become sooner decomposed than teeth[3], removes the weight of that difficulty; but, nothing can ever remove, or stir, the overwhelming difficulty with which the hypothesis has oppressed itself by propounding; "that "*the animals were all at the same time inhabitants of ante-* "*diluvian Yorkshire*[4]*— in some antecedent state of our* "*planet*[5]."

1 *Reliquiæ Diluvianæ*, p. 5.

2 Ibid. p. 10. So also Cuvier: "Ce qui est *certain*, c'est que "l'établissement de ces animaux dans les cavernes est *bien postérieur* à "l'époque où ont été *formées* les couches pierreuses étendues," &c. Tom. iv. p. 307, 8.

3 M. Marcel de Serres states, that the head of a calf, which had been deposited in a cavern by M. de Marsolier in 1780, and examined 36 years afterwards, in 1817—"avoit été *décomposée en entier* dans de cer- "taines parties, dont on ne pouvoit supposer l'existence que *par la pré-* "*sence des dents* qui signaloient la place où devoit exister les mâchoires." *Biblioth. Univ.* tom. xxiv. p. 32.

4 *Reliquiæ Diluvianæ*, p. 35. 5 Ibid. p. 2.

" To the question which here so *naturally* presents " itself," says Mr. Professor Buckland, " as to *what* " *might have been the climate* of the northern hemi- " sphere when peopled with *genera* of animals which are " now confined to the warmer regions of the earth, *it is* " *not essential to the point before me to find a solution:* my " object is *to establish the fact,* that the animals *lived and* " *died* in the regions where their remains are *now found,* " and were *not drifted thither* by the diluvian waters from " other latitudes[1]." Again, " at present, I am concerned " only to *establish two important facts:* 1. that there has " been a recent and *general inundation of the globe;* and. " 2. that the animals whose remains are found interred in " the wreck of that inundation, were *natives of high* " *northern latitudes,* and were *not drifted* to their present " place from equatorial regions *by the waters that caused* " *their destruction*[2]." And again; " the phenomena of " *Kirkdale* are DECISIVE *in establishing the fact,* that ani- " mals which *now* live exclusively in *warmer* latitudes, " e. g. the *elephant, rhinoceros, hippopotamus,* and *hyæna,* " were the *antediluvian inhabitants of Britain,* and not " drifted northwards by the diluvian currents from more " southern or equatorial regions; as has often been sug- " gested, and *was never* TILL NOW *disproved.* And I " pointed out the inference with respect to a *probable* " *change of climate* in the northern hemisphere, which " seems *to follow* from this circumstance[3]." And finally; " another important *consequence* is, that the present sea " and land have *not changed places:*—and, that wherever " such caves and fissures occur, that is, in the greater part " of Europe; and, in whatever districts of the other Con- " tinents such bones may be found under similar circum- " stances; there did not take place any such *interchange*

[1] *Reliquiæ Diluvianæ,* p. 44. [2] Ibid. p. 47. [3] Ibid. p. 162.

" *of the surfaces occupied respectively by land and water,*
" as many writers of high authority have conceived to
" have immediately succeeded the last great geological revo-
" lution, by an universal and transient inundation which
" has affected the planet we inhabit[1]."

It is in the highest degree distressing, (the reader will render me the justice of believing that I speak with sincerity, if he considers, with me, the eloquent and sublime piety of the *Vindiciæ Geologicæ*, and the converging tendency of our respective arguments,) to feel myself compelled to produce these several positions from so high and excellent a quarter, and, at the same time, to present myself in a posture of active opposition to them; yet, I must either desert the cause which I have felt it a sacred duty to undertake, or I must adventure the opposition. I shall, therefore, not hesitate to do the latter; clearly discerning, that the just authority of the Mosaic record is far more deeply interested in the question than the scrupulously abstinent author of the hypothesis has rendered himself sensible; and convinced, that when the first effects of *novelty*, and of an enthusiastic sentiment most justifiably excited, shall have so far subsided as to restore a calm impartiality of judgment to geological science amongst us, my exposition will not be disregarded. It will then be perceived, that the eager and sanguine author, captivated by the allurements of his own new and ingenious hypothesis[2], has inverted the order of the argument; that he *first* determines, that the cave at Kirkdale *was an hyænas' den*, and *then*, requires *Geology* to conform itself to that determination. Whereas, the true order of the argument is assuredly; *first*, to fix generally.

[1] *Reliquiæ Diluvianæ*, p. 162.

[2] " I was *enchanted* to find—the only link that was deficient to complete the evidence *I wanted, to establish the hyænas' den at Kirkdale.*" p. 26, 27.

the *truth of Geology*, that is, the *true history of the origin and revolutions of our globe, and their consequences*, by ascending to first principles and competent authority; and *then*, to interpret the *particular phenomena of the cave* by the rule of that *authoritative truth*[1]. For, there are not, in all the range of human research, propositions more demonstrably *certain* than these; that, *True Geology* must, of necessity, be a *complex science*, in which *physics* are essentially subordinate to *moral testimony* or *history*; that, *simple mineralogy* can no more detect and disclose it, than *simple topography* can detect and disclose the *events and transactions* of *history*; and, that *primitive phenomena*, though they may effectually mislead the *imagination* from it, can never, of themselves, effectually lead the *reason* to it. The *phenomena*, stand like monuments whose record is wholly or nearly effaced; and of which, therefore, little or nothing can be discovered, *unless a collateral trădition survives to enable us to expound them.* Speculation, may amuse itself ingeniously for a time upon the relic, and may appear to have succeeded so long as it is not authoritatively contradicted; but, the production of a tradition well authenticated shall shew, that *ingenuity alone* is the value of the speculation. The monuments of the *Globe* are not, like the ruins of *Palmyra*, destitute of all historical record, and therefore a free common for *invention* to occupy at its pleasure; they are like the monuments of *Greece*, and of *Rome*, where record and history preclude the obtrusions of *invention*, by establishing and maintaining the *presence of authenticated Truth.* What is currently, and abusively, called *geology*, is nothing more than *mineralogical and fossil topography*, with *historical conjectures* raised upon it, differing according to the *imaginations* of the different hypothetists;

[1] "It would degrade the sciences (observes M. Humboldt), to make "their progress depend solely on the accumulation and study of *parti-* "*cular phenomena.*" *Superp. of Rocks*, Pref. p. 6, 7.

whereas *geology*, to be *true*, must have its *root* in *authenticated history*, which *authenticated history*, by Divine favour, we possess.

"The *facts* developed in this charnel-house of the antediluvian forests of Yorkshire," says this spirited writer, "*demonstrate* that there was a long succession of years in which the elephant, rhinoceros, and hippopotamus, *had been the prey of hyænas*, which, like themselves, *inhabited England* in the period immediately preceding the formation of the diluvial gravel; and, IF they inhabited *this* country, it *follows as a corollary*, that they inhabited all those *other* regions of the northern hemisphere in which similar bones have been found[1]." I readily grant the corollary thus *hypothetically* presented; but still, that deceptious IF, is the perilous pivot on which so much has been adventurously staked, and we have already discovered strong evidence of its *insecurity*. A few observations more, will probably appear to demonstrate its *entire inefficiency*.

Mr. Professor Buckland affirms, in the positions which have just been assembled; that the *transport* of equatorial animals to northern latitudes by the diluvial waters, and the *interchange* of the surfaces respectively occupied by *land* and *water*, are now *for the first time* DISPROVED; and, that the *fact* of those animals *having inhabited* antediluvian Britain, is now *for the first time* ESTABLISHED; —by what potent testimony? by the omnipotent evidence of the HYÆNAS' DEN; by the *presence of their remains* in Yorkshire, and by the *phenomena* which he alleges "*confirm his history and chronology of the cave at Kirkdale*[2]." I appeal to all philosophy, natural and moral, I appeal to logic, whether the former fact is in the smallest degree *disproved*, or the latter fact in the slightest degree *established*, by the *evidence thus alleged*?

[1] *Reliquiæ Diluvianæ*, p. 42. [2] Ibid. p. 53.

and I patiently lay up my appeal, for the *future* decision of *reason*. The *Cave of Kirkdale* (it will presently be found,) cannot be considered as constituting an *independent body of phenomena*, comprising in itself all the elements required for solving the great problems of geology; it must submit to be compared and combined with the *Cave of Durfort* and the *Quarries of Kösritz*[1], before its phenomena can acquire any legitimate authority for contributing to the solution of those problems.

To undertake the establishment of *both* the facts here required by the hypothesis, viz.: "1. that there *has been* "*an universal inundation which swept over every part of* "*the globe*, and yet, 2. that bodies were *not drifted by its* "*waters from the equatorial to the temperate regions;*" is manifestly a very discouraging undertaking: because, the *establishment of the first fact* will very probably induce, as its natural consequence, the *subversion of the second*. He who once admits *universal diluvial action*, virtually admits *all partial diluvial action;* and, he can have no authority afterwards to *limit its operation*, but that which he can derive from a *demonstration of the contrary fact*, or *physical impossibility*.

Although Mr. Professor Buckland "does not *think* "that a solution of the question,—*what might have been* "*the climate* of the northern hemisphere when peopled "with genera of animals now confined to warmer regions "—is *essential to the point before him;*" yet he manifestly *feels*, that it is *essential to his hypothesis* "to point out the "*probability of an actual change of climate* in that hemi-"sphere." And, what is this but to *feel* a solution of that question *to be essential*, and to solve it *by implication?* For, the great question to be solved, is not—*How* has the

[1] See after, Note [V.]

climate been changed? but, the previous question — *Has* the climate been changed? Now, if a difference of climate was *necessary* (according to the conviction in the scientific author's mind,) in order to have *enabled the animals to live in northern latitudes,* the *fact* of their *having lived there,* must have *depended* absolutely upon the *previous fact* of the climate *having been changed;* for, the climate did not depend upon the presence of the animals, but, the presence of the animals upon the climate; and therefore, a solution of the question which, abstractedly, he thinks *unessential* to the point before him, he shews, practically, to *be essential* to the proof of the fact which he would establish, and which he affirms, "he is *only concerned to establish*[1]." But, the question of a change of climate *from a greater to a less degree of warmth,* has already been disposed of[2]; and, as the *existence* of that supposed *primeval warmth,* which has been *disproved,* is rendered by Mr. Professor Buckland *essential* to the alleged existence of the animals in northern latitudes, *and is wanted to prove it,* the presence of the *exuviæ* cannot possibly have power to *prove back* the existence of the warmth; for, then the argument would revolve in a vicious circle, and nothing would be proved. The *presence of moveable bodies in the north,* be they what they may, cannot therefore *prove a warm climate in the north;* and more particularly, after we have once been assured, that a "*drifting* or *transporting agent has swept* "*over the whole globe.*" And indeed, the admission, that "*if* any change of climate has taken place, it took place "*suddenly*[3];" when closely examined, will be found to amount to a full acknowledgment, that *no change has taken*

[1] See above, p. 321. [2] Ibid. p. 306, &c.

[3] *Reliquiæ Diluvianæ*, p. 47. So also D'Aubuisson, tom. ii. p. 514. "*S'il* a eu lieu, les faits indiquent qu'il doit avoir été *subit*."

place: for, it acknowledges, that if it did not take place *suddenly*, it did not take place *at all.* Now, that "*suddenly*," can only mean a *sudden shifting of our globe, in the relations of its surface to the sun.* But, so peculiar and extraordinary a *derangement of the earth in its orbit*, cannot with any degree of rationality be inferred *directly*, from the presence of any animal bodies on *any part of its surface:* there is no common relation or proportion between the terms. It must therefore rest upon other and intermediate ground. That ground, to be *solid*, can only be *testimony* or *analogy;* which can alone constitute a *true probability* of the effect alleged. But, we have neither any *testimony* of such a *shifting* having ever taken place in the solar relations of our globe; nor have we any evidence of such a *sudden change* in any other member of the universe, from which we may infer it *analogically* of our globe. It is, therefore, a conception of *pure imagination* or *invention;* and, the proposition in effect concedes, that unless a *conception originating in pure invention has chanced to be realised*, there has been no change of climate from warmth to cold in northern latitudes. And, how far is this concession from acknowledging, simply, *that there has been no such change?* However requisite the *invention* of a sudden shifting may be, to make two parts of a *human hypothesis* hold together; we obtain no ground of *reason* from thence for assuring ourselves, that such an *expedient* has been actually employed in the plans of Omnipotent Wisdom; for, *our imagination* of the expedient, may very probably be only the *consequence of our entire inscience.* We know, indeed, that the conception has existed in the *human mind*, but we do not therefore know, nor have we any reason to believe, that it has existed in the *Divine mind;* and, if we are not *sure* that it has existed *there*, we see very clearly what must be its quality and value as a *principle of geology:* for, *true geology* will

not admit, as a *grounding principle,* any speculation *purely and humanly imaginary*[1].

Neither can the fact of "*an interchange of the surfaces* "*of sea and land,*" receive confutation from an objection founded *solely* upon the *postulated existence and inhabitation* of those animals in northern latitudes. "One *im-* "*portant consequence* arising from the *inhabited caves* "(says the hypothesis) is, that the present sea and land "*have not changed places*:—*since,* those tracts of dry land "in which we find the caves, *must have been dry also* "WHEN *the animals inhabited them*[2]." Who would deny the proposition, that those tracts of land, and their caves, *must have been dry* WHEN *the elephants or hyænas inhabited them?* But, the previous *postulate*—that those animals DID *inhabit them,* I have not only denied, but have assigned the most ample and sufficient reasons for the negation.

That a *diluvium*[3] "has *swept over* every part of the

[1] Of the same quality is Cuvier's principle, that the *chemical nature of the sea has changed at different periods* (*Disc. Prél.* p. 7. *Theory,* § 5.); which principle his system *wants,* in order to establish *its own conclusions* respecting certain successions of *aquatic* fossils. How vast is the distance, between *his necessity* and *the reality!* That distance, however, vanishes in the passion of *system-making.* But, as we have no real evidence whatever, that the *chemical qualities of the sea have ever at any time changed,* nor any philosophical reason for questioning the permanency of its first, *created qualities*; *true geology* rejects such a spurious tender of the *imagination,* however scientifically ingenious. God has not ordered the world by any rule of human ingenuity. It is unphilosophical to consider such *inventions,* as *true inductions of causes from effects* or *phenomena.*

[2] *Reliq. Diluv.* p. 162.

[3] Mr. Professor Buckland appropriates, not only the adjective *diluvial,* but the substantive *diluvium,* to "those extensive and general deposits of "*superficial loam and gravel,* which appear to have been *produced by the* "*last great revolution* that has affected our planet." *Reliq. Diluv.* p. 2.

" globe[1]," and, that its passage was " of short duration[2]," is indeed manifest to every sound intelligence that attentively and adequately investigates the phenomena. But, when we would inquire—*What constituted that diluvium—from whence did it come—what physical causes put it in motion*—and *where is it now?*—if the mind is too eager to pause where the *reason* must pause to obtain an answer to these important questions, it can only advance by the *imagination* exercised upon the *phenomena*. Acting by that deceptious power alone, and under no other authority than that which it fancies it derives from the *phenomena*, it immediately betrays the narrowness of its native resources. It assumes, *à priori*, as a fact too secure to need any consideration, and therefore, as a *first axiom* of its geology, that the *present* terrestrial surface must, of necessity, be *the same* that preceded the flux of the *diluvium*, and consequently, that the movement of the *diluvium* consisted, 1. of a *progress* upon, and 2. of a *regress* from, *one and* the *same terrestrial superficies*. The posture of mind in which this is assumed, is analogous to that of a person who concludes, that what he finds in his own country must necessarily be found in all other countries. We have had *no experience* of any other surface of our globe, we *never thought* of any other surface, *therefore*, there *never was* any other surface; and, consequently, as we find vestiges of the *departure*

This transfer of the name of the *cause* to the *effect*, is attended with some little confusion in the mind; because, *Mr. B.'s diluvium* remains still on the earth, whilst the *true diluvium* has departed from it. I therefore reserve the term *diluvium*, to signify exclusively the *mass of waters* which were put in motion to overwhelm the former earth; and I shall use the term *colluvia*, to express the general *loose residue* of mud, or loam, or gravel, or pebbles, *which those waters spread and left on the surface of their basin at the final period of their effusion from it.*

[1] GREENOUGH'S *Geology*, p. 155. [2] *Relig. Diluv.* p. 256.

of a diluvium, that *departure* must necessarily imply a *retrocession from,* and must virtually include an evidence of *a previous advance upon, the same surface.* But, no powers capable of causing such an *advance,* and of propelling an inundation that should rise above the highest mountains, is *now* discoverable among the known agencies of the globe; therefore, we must admit an *occult physical cause,* and *imagine* our planet to have changed the axis of its revolution; or, we must quit the earth, and *imagine* the operation of a comet, or of some other sidereal cause, as the first *physical impulsor* of that *advancing inundation:* for, though "the discoveries of modern geology prove to "demonstration, that there *has been* an universal inunda-"tion of the earth, yet (most certainly) *they have not* "*shewn by what physical cause it was produced*[1]."

To such an issue, we are inevitably brought by a course commencing from the point where *reason* halts for light, and where the Pegasus of *imagination* is at once mounted, to carry us on where *reason* declares its inability to proceed without the aid of *competent evidence.* But, as soon as that *evidence* is presented to the *reason,* all its wants are satisfied; it then needs, neither the aid of an *occult physical cause,* a *change of the earth's axis,* or a *comet.* It goes forward with a very different sense of security, from that which accompanied the excursion of the *imagination.* It is not only convinced, that a "*diluvium has swept over* "*every part of the globe,*" and, that its passage "*was of* "*short duration;*" but, it can *fix the term of that short duration,* and can apprehend the *nature and manner of its sweeping.* It can pronounce, — That its *regress* or *departure* alone affected the *present* terrestrial surface, whilst its *progress* affected a *preceding* terrestrial surface which sunk and perished beneath it; and, that those terms are therefore relative to *two different subjects,* and would be

[1] *Reliquiæ Diluvianæ,* p. 225, 226.

more properly expressed by *egress*, and *progress: egress from* the present surface, and *progress upon* the former surface. It can pronounce, That the *entire mass of the ocean* constituted that *diluvium:* That it *came* from its *original bed:* That it was "*called from that bed, and was* "*poured upon that former surface*[1]:" That the secondary or *physical* cause that *put it in motion*, was the "*breaking up of its fountains or receptacles*[2]" and removal of its ancient boundaries, by the disruption, depression, and subsidence of the terrestrial surface which had before *encompassed and confined it*, to a depth profounder than that of its own bed: That it "*swept* "*over*" the whole of the *present* surface, in the course of its *departure from it* and of its *transfusion* into that *new profundity*, widely spreading the *colluvia of its basin* in evidence of its retreat: That the "*short duration*" of its passage, was the *year* assigned in the record: And, that the "tearing up of solid strata and the reduction of the "surface to a state of ruin and disorder[3]," which its *departure revealed* and which are precipitately assumed to denote "the *destruction* and *remodelling* the face of the "*same antediluvian surface*[4]," was in fact the eventual manifestation, of the *hitherto concealed primitive ruin which had formed the sea-bed in the first revolution of the globe;* and also, of the subsequent various and violent action of the sea, exercised upon its own soils, 1. *during its long permanency on them;* and 2. *in the course of its furious defiux from them*, when it abandoned vast continuous masses penetrated with its waters and loaded with various deposits marine and terrestrial, leaving them to be *converted by induration into secondary rocks:* from which two

[1] See above, p. 36; and *Introduction*, § 11. [2] Ibid. p. 31, 32.
[3] Greenough, laudat. ap. *Reliq. Diluv.* p. 224.
[4] *Reliquiæ Diluvianæ*, p. 42.

last consecutive and *differing periods of its action*, have resulted those *differing phenomena* which have given occasion to the vague and uninstructive discriminations, of *more* or *less ancient secondary formations*. Thus, it is empowered, by drawing succour from a *competent source*, to reply to the important question of D'Aubuisson respecting the highest summit of the Pyrennees, the *Mont Perdu*, "*containing* "*a prodigious quantity of marine substances:*"—"What "*incomprehensible revolutions* can have disposed these "beds; and have produced, *precisely upon the most ele-* "*vated point in a circumference of two hundred leagues, a* "*rock and bodies which appear impossible to have been* "*produced and deposited any where but in the* BOTTOM "OF THE SEA[1]?" And, thus it is at length enabled, not only "to demonstrate that there *has been* an uni- "versal inundation of the earth[2]," but also to shew (what

[1] "Quelles *incompréhensibles révolutions* peuvent avoir redressé ces "couches, et avoir produit, *précisément sur le point le plus élevé à deux* "*cents lieues à la ronde, un rocher et des corps qui semblent pouvoir ne* "*se produire et ne se déposer que dans le* FOND DES MERS?" Tom. ii. p. 335.

[2] Through an inconsideration of the respective testimonies of *primary* and *secondary* formations, and through a too passive submission to the conclusions of naturalists, the learned M. Larcher has been seduced, by the plausible argument of De Luc, to deny the universality of the Deluge. Although he declares (*Traduction d'Hérodote*, tom. vii. p. 12 and 124), "that he is intimately persuaded that the sacred Scriptures *contain* "*nothing but what is true;*" yet, he thus discourses: "shells are found "in Europe, Asia, and America, on mountains loftier than those of "Egypt; but, that only proves, that all those countries have been "*partially* covered by the waters of the sea. I say *partially*, because "it *appears certain from the observations of the ablest Naturalists*, that "the summits of the highest mountains *have not been covered by those* "*waters*. During the time of the Deluge they were *so many islands*. "M. de Haller says—'that no species of shells are found on the *highest* 'summits of the Alps, from which *fact* we may *calculate* pretty nearly 'the elevation of the waters in our hemisphere.' (*Recherches sur les*

the discoveries of modern geology never could have shewn by virtue of their own energies), " *by what physical cause*

" *Américains*, tom. i. p. 25, *note*.) To the testimony of the Baron de " Haller, I shall add that of Seba. ' It is evident from observations, ' that *petrifactions* are never found on the *summits of the loftiest moun-* ' *tains*, and very rarely on inferior summits. Those mountainous sum- ' mits were *therefore*, at the time, so many islands of various altitude ' and extent, standing out of the waters. As, at the present day, all ' islands appear to be only mountains rooted in the bottom of the sea; ' whose summits, of various elevations, erect themselves above the mari- ' time surface, so as to exhibit an habitable soil.' (*Thes. Rer. Nat.* tab. 106, p. 125, tom. iv. Amst. 1765. " When I maintain, with " these men of science from whom I quote, that the summits of some " mountains were not covered by the waters of the Deluge, I have not " the most distant design of assailing the truths of Religion. It is *suf-* " *ficient to believe*, that all men perished in the Deluge except Noah and " his family. On this question, I refer the Orthodox to the advertise- " ment of the pious and scientific Editor of M. De Luc's *Lettres sur* " *l'Histoire Physique de la Terre*, p. 17." (*Trad. d'Hérod.* not. 36 to lib. iii. cap. 12, tom. ii. p. 186.) Yet, the Scriptures, which M. Larcher is persuaded *contain nothing but what is true*, affirm positively and expressly, that the aqueous surface covered the summits of all the mountains (see above, p. 217, 8, and *note*). The learned annotator on Herodotus, in his unqualified deference to the opinions of Naturalists on a subject not wholly of their competence, did not reflect, that the *highest* eminences of the globe, being of *primitive* formation, could not be expected to contain shells, or any other extraneous matter; and therefore, that the absence of these is no evidence whatever that those eminences were not surmounted by the waters of the ocean. But, the loftiest eminence of the Pyrennees, which is of *secondary* formation, abounds with such extraneous matter; and, there are many *inferior* levels in which none is to be found. It is therefore a pure and weak illusion, to assume, that the highest elevation of the diluvial waters can be in any manner *ascertained* or *calculated* by the termination of the imbedment of marine remains. If the waters covered the loftiest *primitive masses* and afterwards retired, they could not have incorporated any organic evidences of their presence; and none are ever found loose, but such as have become detached by the decomposition of the mass into which they had once been incorporated.

" *that universal inundation was effected,* which produced " *an interchange of the surfaces occupied respectively by* " *land and water.*"

Mr. Professor Buckland has thoroughly verified, by the activity of his own personal researches, the truth of the important GEOLOGICAL FACT first declared by Cuvier[1]; *that* ALL *the caves of England and Germany containing animal remains,* (which form the chief subject of the *Reliquiæ Diluvianæ,*) *exist in* CALCAREOUS *or* LIMESTONE FORMATIONS; he observes, that " *it is* " *a property common to compact limestones, of all ages* " *and formations, to be perforated by irregular holes and* " *cavities intersecting them in all directions,* and that *the* " *cause of the cavities has never been satisfactorily ex-* " *plained;*" but yet he adds, " that it is *foreign to his* " *purpose to inquire into this question, which is one of con-* " *siderable difficulty in geology*[2]."

It must indeed be a matter of considerable, nay of insuperable difficulty in geology, to explain satisfactorily the *cause* of the irregular *intersecting chasms* in limestone formations, unless we take adequate account of the evidences testifying irrefutably to the *two facts*—that *the limestone was once in the state of a moist paste;* and, that it *afterwards became exposed to all the natural consequences of the drying of such a paste.* But, as soon as we apprehend and reflect on these undeniable facts, the intersecting *fissures* and *caverns* offer no difficulty whatever, but present themselves as natural and expected *effects,* proclaiming their own proper *causes;* as the *cracks* in a lump of *moist clay,* or *plaster of Paris,* set to dry *in the sun.* For, as has already been observed, *the magnitude of a subject does not alter the operation of its principles*[3]. It was probable, therefore,

[1] See above, p. 107.

[2] *Reliquiæ Diluvianæ,* p. 5.

[3] See above, p. 118.

1. that such *fissures* would have been produced in such a substance, simply by the *process of desiccation;* it was probable, 2. that the *separations* of the mass constituting the *fissures,* would often be determined by the presence of such *foreign bodies,* mineral or animal, as had been *introduced within it*[1]. It seems probable, that in the first of these cases the *cleft* or *fissure* would have commenced at the *surface of the mass,* which was the part first affected by the influence of *air* and of *heat;* and, that in the last case, the formation and direction of the fissure would have been determined *from within.* The crystallisation, or spar, which so commonly lines and often entirely fills up some of the smaller fissures in limestone rocks, is another direct and incontrovertible voucher for the former presence of a *fluid* that once penetrated the whole mass; and which, percolating through it into those fissures, there deposited the spathetic matter that we witness. Other fissures, determining the course of the *superabundant fluid within*

[1] " Quelle est l'origine de ces cavernes ? Je ne saurais la voir, avec " quelques personnes, dans la cause qui a produit les *cavités bulleuses* " que présentent un grand nombre de pierres calcaires, et qui paraissent " dater de *l'époque de leur formation.*—Il paraît *que les cavernes sont* " *bien plutôt une suite de la nature calcaire des terrains, et des substances* " *qu'ils contiennent, qu'une circonstance dépendante de l'époque où les ter-* " *rains ont été formés.*"—D'Aubuisson, tom. ii. p. 380, 382. This able inquirer, whose sagacity, and general freedom from hypothesis, commonly bring him as near to the point he seeks as it is possible to arrive by *unassisted physical research,* here directs our contemplation to the limestone in its *two* successive stages, 1. of *fluidity,* and, 2. of *solidity.* (See above, p. 108, *note.*) In the *first stage,* those *bullous* or *airy cavities* would be produced in the interior of the fluid mass by obvious causes; as, by the accidental concurrence of acid principles with the calcareous particles, &c. In the *succeeding stage,* when the paste became permanently exposed, and began to desiccate and indurate, clefts and hollows would indeed ensue, naturally, as " *a consequence, of the calcareous nature* " *of the soil, and of the substances which it contained.*"

in its descent, became *channels* for its escape; which fluid, discharged through those channels, continually *enlarged them* in its passage, by washing away the loose and as yet incohesive matter of their sides: by which natural processes, "*irregular holes and caverns, intersecting the lime-*"*stone in all directions,*" would necessarily have been produced[1]. By thus apprehending the *fluid state of the limestone, at the period when the transfused ocean first abandoned it on its bed now our earth;* we not only perceive, "that there was a time when the dimensions of the "channels were *less* than they are at present," but we are enabled to ascertain "by *what cause they were originally* "*produced.*" And, the "half-corroded fragments of "*coral, shells,* and the *spines of echini* incorporated into "the limestone sides and roof of the cave at Kirkdale, "identical with the organic remains of the Heddington "limestone quarries near Oxford; both which rocks are "referrible to the same oolite formation[2];" are eloquent pledges — of the *former fluidity* of the mass — of the *specific fluid* that pervaded it—and of the *process* by which it has become *indurated into rock.* How, then, it can be "*foreign to the purpose of the geological argument*" to inquire after the *cause of the* "*irregular holes and inter-*

[1] "*Caves in limestone* are usually more or less connected with *fissures* "*of the rock in which they exist;* and the solid matter that once filled "them, appears in many cases to have been *carried off through the* "*fissures by the long continued and gradual percolation of water,* re-"moving the softer or decayed portions of the rock."—*Reliq. Diluv.* p. 5, *note.* "These two kind of apertures (fissures and caverns) rarely "occur separate, and many of the caves appear to be only *enlargements* "*and hollow side-branches shooting off from a fissure, or congeries of con-*"*nected fissures.*" Ibid. p. 142. But, *from whence* was that abundance of *water* and previous saturation of the limestone, according to the *geology of the hypothesis?* This important consideration is entirely overlooked by it.

[2] *Reliquiæ Diluvianæ,* p. 4.

" *secting cavities common to compact limestones of all ages* " *and formations,*" or, how the *geological conclusion can establish itself at all without the inquiry,* appears to me, I must acknowledge, perfectly incomprehensible. The position, " that *fissures undoubtedly existed on the antedi-* " *luvian face of the earth in much greater abundance* " *than since that grand aqueous revolution*[1]," merely because they exist on its *present desiccated surface,* without inquiring for the *cause* of their existing on it at all, either *now* or *then,* is so purely imaginative, and so undisguisedly without support from moral evidence, that its weight is absolutely *zero* against the arguments which have been here enforced; and it has manifestly been resorted to, only from a *sense of difficulty* to account for the contents of certain of the *vertical fissures*[2] without gratuitously *assuming,* that those contents *must have fallen into them from the surface above, before the deluge.* And yet, had the diluvial waters, as the hypothesis supposes, rolled for twelve months *over and into the mouths* of such fissures, it is plain that they must have so acted upon the soluble surface of the calcareous mass, and the sharp angles of the fissures, as to have totally *destroyed the distinguishing characters* which they now wear; and which are simply those of openings, or gaps, in a *dried paste,* which could only have taken place *after the final departure of the fluid which once saturated it.*

The same principle, extends to the formation of those *series of valleys* which intersect the great limestone formations. " An agent thus gigantic," (*i.e.* " a body of waters " like the ocean, pouring in over the land *when its level* " *was destroyed,*") says Mr. Professor Buckland, " appears

[1] *Reliquiæ Diluvianæ,* p. 56, also, p. 79.

[2] At Oreston near Plymouth (*Reliq. Diluv.* p. 77, 78); at Fouvent, near Gray, in France; and at Kösritz, in Saxony, (Ib. p. 25, 26).

" to have operated universally on the surface of our " planet, at the period of the deluge; the spaces then " laid bare by the sweeping away of the *solid materials* " that had before filled them, are called *valleys of denuda-* " *tion*[1]." But, if we suppose the limestone to have been *solid* at the time when the waters swept away the materials which before filled those valleys, we may well observe, in his own words on another occasion; " it seems impossible " to ascribe the formation of these to a period so short, as " the *single year* occupied by the Mosaic deluge[2]." The very *symmetry* which characterises " their several branches " and inosculations[3]," the sinuous and easy courses of those which are so well represented in the map of the district of Muggendorf[4], distinctly testify; that it was a *soft and submissive,* not a *solid and stubborn* material, that has been swept or *scooped* away. This operation cannot be more excellently described than in his own forcible and elegant language, which goes, in a main degree, to confirm my argument: " The *valleys* are the effect of deep " denudation produced on the *oolite limestone,* by a " volume of water rushing over strata composed of uni- " form and *moderately yielding materials.* Any irregular " projections that might have existed on the original " surface would cause the waters to descend with acce- " lerated velocity over the intermediate depressions, and " *to excavate that series of sweeping combs and valleys* " *that wind with the regular flexures of a meandrous* " *river, and present masses of land alternately advancing* " *and retiring with all the uniformity of the salient and* " *re-entering angles that mark the course of running* " *water*[5]." Here, is no character of that violent and conquering *rupture* which the resistance of *solidity,* such

[1] *Reliq. Diluv.* p. 237. [2] *Vindiciæ Geologicæ,* p. 30.
[3] Greenough, laudat. ap. *Reliq. Diluv.* p. 224.
[4] *Reliq. Diluv.* Plate 19, and p. 125. [5] Ibid. p. 256.

as that of limestone actually consolidated and compacted, supposes, but only of that uniform and easy *protrusion* which implies *incohesion of elements and pliancy of mass*, as in clay saturated with water; and therefore, the author is here constrained to exchange "*solid*," for "*moderately* "*yielding materials.*"

To say, with the excellent author from whom he quotes, "we are *at a loss to conceive* what the power "of such a machine *might be* when once in operation[1]," and thus to get rid of the difficulty, is to take refuge in an *occult cause* or *agency;* for, the agency that we are *at a loss to conceive*, by which the sea could have *chiselled out the valleys in perfectly solid limestone* "*in so short* "*a period*," and with those "*regular and meandrous* "*flexures*," is absolutely *occult* to us; and, to ascribe to it specific effects, is undeniably to ascribe those effects to an *occult cause*. But, when we have *prior grounds* for contemplating the *limestone* as not merely *moderately yielding*, but positively *fluid* or *semi-fluid*, during the period of that operation; the *agency* that excavated *submarine* valleys which have since become *super-terrestrial*, is not *occult*, but *overt* to our intelligence: whether the excavation was entirely effected within that *single year*, or was in previous course of formation by submarine currents in the *pristine bed of the sea*.

Again; when it is asked,—"*Where* is such a power "to be found, but in the agency of the *diluvian waters*— "which can be referred to *no physical cause at present* "*in action*, but to *some extraneous and mighty power*[2]?" the appeal is made to an *occult power*. But, when we are led to witness *the same physical cause in constant action at the present hour*, and exercising the same mighty power, in the same manner as heretofore, *on the soils which are now*

[1] *Reliquiæ Diluvianæ*, p. 237. [2] Ibid. p. 214.

subjected to it, we are able to refer the phenomena to an *overt cause* which we are at *no loss to conceive,* and not to an *occult one;* not, to "*a body of waters like the ocean with* "*its level destroyed,*" or to "*some extraneous power,*" both which are purely *ideal,* but, to the *body of the oceanic waters themselves,* always subjected to the same laws of *hydrostatics,* and which are real, present, and tangible. When we *suppose* the body of the sea to have *ascended from its bed by the destruction of its level,* over the terrestrial surface and contrary to the laws of gravitation, and to have afterwards *descended* into the same bed again, conformably to those laws, we are obliged to ascribe the first, incomprehensible effect, to an *occult physical cause* purely imaginary; but, when we can perceive that it *only descended from its bed* by the established laws of gravitation, and that its *descent* was the consequence of the removal and depression of the boundaries which before had confined it, of which operation we have already had *historical experience from revelation* in the disruptive and fragmentary formation of the *first sea-bed;* we ascribe the effect, with authority, to an *overt* secondary physical cause, which *overt* secondary cause connects itself *immediately* with the *First Physical Cause,* which is also the *First Moral Cause*[1].

From the same precipitancy of hypothesis, the distinguished Professor denies the *transport* of the animal remains found in the caves of Franconia, the Hartz, and Westphalia, by the great oceanic *diluvium*—because, *animal substances* have not always, and equally, accompanied the *mineral colluvia* of its basin; "for, had they "been *drifted in together,*" says he, "the former would "*probably* have been *distributed coextensively* with these "latter substances, and in *small quantities;* whereas, on

[1] See above, vol. i. p. 61 and 130.

" the contrary, whilst we find in every cave nearly the " same proportion of *diluvial loam and pebbles*, the occur- " rence of *bones* is *limited to a small number* (of caves); " and in these, they are *crowded in such enormous quanti-* " *ties*, and are attended with such circumstances, as are " *explicable only* on the hypothesis of their (the bones) " having existed there before the introduction of the *dilu-* " *vium* (*colluvia*); and, in general, the deeper we de- " scend, the more abundantly loaded do we find the lower " regions and undervaultings to be, till they are entirely " choked up with *mud, pebbles*, and *bones*. The mud and " pebbles were not introduced at a period anterior to that " in which the caves *were inhabited;* for, *in this case*, they " would have found a separate bed at the bottom, beneath " the bones, and not have been dispersed so equally as " they are amongst them: *e. g.* we find the pebbles " occur as abundantly at the top, as at the bottom and " middle region of the great heap (of bones) that lies " piled together to the height of twenty-five feet in the " lowest region of the cave at Gailenreuth[1]."

The whole of this reasoning is determined by the constantly governing prepossession, of *inhabitation by wild beasts;* but if, instead of " *inhabited by wild* " *beasts*," which is *uncertain*, we only read, " *abounding* " *with the remains of wild beasts*," which is *certain*, we shall find the reasoning run to a very different conclusion.

Of the different accumulations of *fossil animal exuviæ* which have been discovered, some are found in the *close strata*, and some in the *fissures or caverns*, of *limestone rocks*. To these *two classes* of accumulations, Mr. Professor Buckland assigns *three distinct and different causes*. The *first class*, he supposes to have been *drifted by the diluvial waters*. To the *second class*, which he divides,

[1] *Reliquiæ Diluvianæ*, p. 143.

he assigns two distinct causes; 1. that the animals *fell into vertical fissures* from the antediluvian surface of the earth, and there perished[1]: 2. that antediluvian beasts of prey took possession of *caverns in limestone rocks*, which they *inhabited*, in which they were *born*, in which they *died*, and into which they *brought* a large proportion of the *bones* that we discover in them. The *first* of these three causes, I entirely admit; only I maintain, that the diluvial action, which he acknowledges to have been *universal*, extended as far as *from the tropics to our latitudes*, and was not limited to the *immediate vicinity* of the animal deposits, to which Mr. Buckland would *arbitrarily restrict it*. The *second* cause, I must altogether deny, for the reason already assigned; *viz.* that the vertical fissures, apparent or masked, in the present terrestrial surface, are necessarily *postdiluvian*, resulting wholly from the *desiccation* and *cleaving* of that surface after the departure of the waters which had penetrated and saturated its substance[2]. The *third* cause, I must as decidedly refuse, on the ground of the arguments which have already established, 1. the incongruity of supposing *tropical genera* to have existed in *northern latitudes*; 2. the *fluid state of the limestone* at the period when the bodies were received into it: from both which will follow, the *impossibility* of tropical genera having ever *inhabited* the limestone caves of Yorkshire or Germany. Whilst, on the other hand, the *first simple cause* assigned, viz. *diluvial drifting* or *transport*, if not *unwarrantably limited*, will account equally for ALL *the phenomena*.

How it is possible for the philosophical author to inspect the valuable plates of his own *Reliquiæ Diluvianæ*, (which are certainly faithful representations of their ori-

[1] *Reliquiæ Diluvianæ*, p. 26, 78.

[2] See the description of such fissures, ib. p. 79.

ginals,) and not to abandon the prepossession of *inhabitation*, is, to my apprehension, a subject of amazement. Those plates exhibit the most accurate delineation of the characters which are drawn on the mind, in contemplating masses of animal bodies of all ages and growth, indiscriminately mingled, "crowded together in enormous "quantities," transported from equatorial latitudes on the surface of water, and deeply immersed into a *once penetrable calcareous paste;* and there left to the *conflicts*, of *inflating the interior of that paste*, before it became indurated, into *vaults and chambers*, by the powerful confined vapours developed in the fermentation of their immense corruption[1], or, of *sustaining its compressive power*[2], as it gra-

[1] "In this single cavern (of *Külloch*), the size and proportions of "which are nearly equal to those of the *interior of a large church*, there "are hundreds of cart-loads of black *animal dust* entirely covering the "whole floor. The quantity of *animal matter* accumulated on this floor, "is the most surprising, and the only thing of the kind I ever witnessed; "and many *hundred*, I may say *thousand individuals* must have contri-"buted to make up this *appalling mass of the dust of death.*" (*Reliq. Diluv.* p. 138.) "I have stated, that the total quantity of animal matter "that lies within this cavern, cannot be computed at less than 5000 "cubic feet; now, allowing two cubic feet of dust and bones for each "individual animal, we shall have, in this single vault, remains of at "least 2500 bears." Ibid. *note*. This description exactly corresponds to that of Esper, as reported by Professor Jameson. "Here the prodi-"gious quantity of animal earth, the vast number of teeth, jaws, and "other bones, and the heavy grouping of the stalactites, produced so "dismal an appearance, as to lead Esper to speak of it as a fit temple "for a god of the dead. Here hundreds of cart-loads of bony remains "might be removed, bags might be filled with fossil teeth, and animal "earth was found to reach to the utmost depth to which they dug." Note M. to CUVIER'S *Theory of the Earth.*

[2] "In the case of the German caves, the quantity of bones is greater "than could have been supplied by ten times the number of carcases "which the cave, if crammed to the full, could ever have contained "at one time:" wherefore, it is hypothetically concluded; that they were derived from the carcases of bears that "*lived and died in them*

dually became compacted and consolidated. It is eminently observable, in the caves represented in Plates 14, 15, 17, 20, 21, in all which are evidences, more or less abundant, of *animal decay*, that the roofs are *concavated into vaults*. "These caverns (of Germany) are composed "of a succession of *vaulted chambers* communicating with "each other by long and narrow passages, ascending and "descending irregularly *through limestone rocks*. The "quantity of bones contained in the uppermost chambers, "is comparatively small; but, as we descend deeper, we "find them more and more abundant, till, at length, in "the *lower vaultings*, or *cellarage*, they are accumulated "in enormous heaps, and the vaults themselves become "entirely filled and choked up with a congeries of bones, "pebbles, angular stones, and mud, piled confusedly "together[1]:" whereas, in the cave represented in Plate 16, in which there is *no evidence of animal decay*, there are *no lofty vaults*. The Professor himself has cursorily noticed *this difference*, but has suggested no *cause* that may have occasioned it: "*no bones*" says he, "have been as "yet discovered in it; *nor does it contain such lofty and* "*broad chambers* as those of Scharzfeld and Baumans "Höhle[2]."

Now, to what more probable *general cause* can we ascribe this singular and notable *difference*, than to the *absence* in the cave at Pl. 16, of *some cause* which had acted in all the other caves? And, to the absence of what

"*during successive generations.*" (*Reliq. Diluv.* p. 97.) But, we have no reason whatever for supposing, that brutes cohabit with the corrupting carcases of their species; on the contrary, we have good reason to believe, that they are as averse to such associates as ourselves. And, the *contractile and compressive power* of the indurating and indurated limestone, adequately accounts for the *actual disproportion of the Cave* to the bulk of its *original contents*.

[1] *Reliquiæ Diluvianæ*, p. 109, 110. [2] Ibid. p. 122.

particular cause can we more reasonably refer it, than to that of the incalculably powerful agency of the putrid vapour developed from corrupting carcases, fermenting within a *yielding mineral paste*, and labouring for a *vent*? For, although elastic vapours might have been generated from other causes, productive of dilatation; yet, that generated from an enormous quantity of *putrid animal fermentation* must necessarily have produced its separate and proportionate effects. When we know the power of such a vapour, developed from a *single body* within a closely soldered leaden coffin, to distend and *concavate* that strong encasement, we possess a secure *datum*, by which we may be able to form a sufficient general calculation of the power of the vapour that must have been generated from a multitude of corrupt bodies, to distend and concavate the interior of a *plastic mass*, which, in *drying*, would retain the concavations it had received; and, the continually expanding but confined vapour ascending from the *inferior congeries of bodies*, would have naturally forced its way upwards; distending and protruding the yielding calcareous mass, and forming in its ascent the successive vaultings and communications which have been above described in the German caves. If a *spiracle* or *vent* was *soon* effected for that vapour, (as appears to have been the case at *Kirkdale*,) the cave would probably continue small and unvaulted; if *otherwise*, it would probably be swelled into *vaults*, as at Paviland, Oriston, (in which it does not certainly appear that a *vent was ever obtained*[1],) Scharzfeld, Gailenreuth, and Bauman's Höhle. We here

[1] *Reliquiæ Diluvianæ*, p. 80. It is only inferred *theoretically*: "I ex-" pressed a *decided opinion*, that the caverns *must have had* some commu-" nication with the surface, through which the bones *may have been intro-" duced*." This *decided opinion*, is made to *predetermine the fact* in all similar cases.

see a just proportion of *magnitude* preserved, between the *effect* and the *cause;* but, when we compare the effect with the causes assigned in the hypothesis, viz. "*beasts*' "*dens*, and *the agency of their inhabitants*," all relation of proportion is lost and disappears. And, the description of the multitudinous contents of the cave at Oriston, of which it is granted, that "there is *no reason* to believe "that the animals which it contains *were introduced by* "*the agency of the hyænas whose remains are found in it*[1];" and those of the accumulations at Canstadt, in Wirtemberg; between Kahldorf and Reiterbuck, in Bavaria; between Osterode and Dorste, on the W. base of the Hartz Forest, and in the Val d'Arno; all which are expressly acknowledged to be "*diluvial deposits*[2];" go very far to constitute a confirmation of the probability, that the *cause* of all the assemblages of bodies was *one and the same in all cases*, whether in *diluvial detritus*, or in *caves:* the latter, occurring only in rocks of *secondary formation by desiccation*, whose induration, we have the best reason to believe, dates only from the period of the *deposition of that diluvial detritus*[3].

[1] *Reliquiæ Diluvianæ*, p. 73. [2] Ibid. p. 26.

[3] Cuvier, distinguishes the carnivorous animals—of *stony strata*—of *movable strata*—and of *caverns*—("les carnassiers des *couches pierreuses*, "des *couches meubles*, et ceux des *cavernes*,") as if there was something so essentially different in those several *positions*, as to indicate *causes and periods* equally different. (*Ossemens Foss., Résumé Général*, tom. iv. p. 487.) So De Luc affirmed; "We must not confound these phenomena, which *differ essentially*." (See above, p. 331.) And yet, the "*stony strata*," and the strata of the *limestone* in which the "*caverns*" occur, differ in nothing but in *circumstance* or *accident;* the desiccated calcareous paste of the one, being *close and compressed*, and that of the other, *fissured and cavous*. And, the only difference between all the *three*, as it concerns the *geological argument*, is this: that, on the departure of the waters, the *stony strata*, whether *close* or *cavous*, dried with *cohesion* of their particles, but the *movable strata* with *incohesion* of their particles:

The proposition, that, if the *animal bodies* and the *mineral colluvia* of the sea-bed had been *drifted in together*, "the former would *probably have been distributed coextensively with the latter*," is evidently a proposition of *theory*, founded upon some previously established but unexplained *rule of regularity*; and may be adequately met by the counter-probability, that such would *not have been the case*. For, that cases should occur in much greater frequency in which masses of *pebbles*, drawing down *mud* along with them, were immersed into the limestone pastes of the sea-bed by the vortices of the ocean, *unaccompanied by animal exuviæ*, and therefore, that the occurrence of immersed *animal bodies* should be *comparatively rare*, is undeniably the *most probable* case of the two; considering, that the presence of the *mineral colluvia* was universal and unlimited in the sea-basin, but that of *animal bodies* limited and local. Where a mass of pebbles and mud had been immersed, the desiccating limestone would probably receive a *tendency*, from the *intrusive foreign matter*, to *cleave* and form a *fissure* in that particular part; and, according to the *dimension* of the fissure, those substances would either remain suspended in it, or fall to the bottom. That, in cavities containing animal remains, pebbles should, in some instances, as at Gailenreuth, have accompanied them to every stage of their descent; and, that in other instances, as at Kirkdale, no pebbles should have followed them; must have depended upon the *materials*

all the *three*, however, were *equally moveable* at the same common period, when they enveloped the dispersed sunken carcases whose remnants they now severally contain. Cuvier forgets, that a *single body* compressed into a *stony stratum*, is as truly *within a cavity*, as the 2500 congregated bears inclosed within the *cavern* of Gailenreuth. See also p. 305, *ibid.*, where he opposes "*les cavernes*" to "*les grandes couches meubles*;" not considering, that the *limestone strata* in which are the *caverns*, were themselves also "*meubles*," before their exposure, fixation, and induration.

actually on the surface of the sea-bed in the point where they sunk. And here I must observe, by the way, that the phrase *drifted in,* is very inadequate to represent the operation that the history instructs us to infer; in which we have to contemplate, not the drifting *rippling* of a tranquil sea, but in many cases, assuredly, a turbulence of action not less tremendously powerful than that of the storms off the Cape of Good Hope, the hurricanes and tornados of the West Indies, or the reported vortex of the Malström of the Norwegian Sea[1].

Mr. Professor Buckland rests a main part of his "*history,*" and the whole of his "*chronology of the den,*" upon the circumstance of the Kirkdale cave having *two strata* of stalagmite, the one *beneath,* and the other *above,* the diluvial *sediment* or *mud* deposited on its floor; and he would infer, that the two formations of stalagmite could not be the productions of the same period and the same cause, but that the intermediate sediment must necessarily have been introduced after the lower stratum of stalagmite had been completely formed, and before the operation of the stalactite which has incrusted the upper surface of the mud; and, from this inference he would deduce two distinct "*periods*" in the "*history of the den;*" 1. a "*period*" antecedent to the introduction of the sediment, and before the hyænas took possession of the cave; and 2. a "*period*" subsequent both to the destruction of the hyænas by the diluvium and the introduction of the sediment; proving the inhabitation of the cave by those animals at the time of the irruption of the waters. Now, with all deference and respect, I must adventure to observe; that the *phenomena,* if closely investigated, appear to be totally insufficient to sustain the inference drawn in the *first instance.* "Stalagmite," he says, "though it often occurs

[1] See above, p. 26; and Introduction, § 27.

" *transfused bodily through* the substance of diluvial se-
" diment, is *never* found in continuous strata *alternating*
" with other strata of mud and pebbles, but *always* form-
" ing *a single crust on the upper surface of the sediment.*
" I could not find in any of the German caves a *lower*
" *crust* of stalagmite formed, *as at Kirkdale*, on the sur-
" face of the subjacent limestone rock." Yet, as he immediately adds—" *but*, from the thickness of the *diluvium*, " there were so *very few points* in which it was *possible to* " *make any observations upon this subject*, that at present " we are *without any evidence as to its existence or other-* " *wise*[1]"—the latter observation, manifestly neutralises all the effect of the former. That there are no *alternations* of those substances, and that " the mud was introduced " *once, and once only*[2]," I entirely believe; *alternations*, as has been already stated[3], imply, at the least, *duplicates of both subjects.* But, that an *upper* and a *lower* stratum of stalagmite, inclosing a single stratum of sediment, may be *varying effects of the same operating cause*, and therefore, that they are not truly indicative of *different periods*, in the extensive sense in which he here intends the term *period*, I must also as entirely believe. Mr. Buckland does not seem aware, that he has himself pointed out to us *two distinct operations of the same cause*, tending to the production of that *two-fold deposit.* It is of the nature of the stalagmitic fluid, *always* to deposit the calcareous matter with which it is charged upon *the lowest surface to which it can attain.* We find it deposited on the bottoms of springs and wells; and, wherever it has been *intermediately* deposited, it has been *intercepted in its descent* by the obstructing body which is incrusted with it. This position will be readily granted. Now, (says the hypothesis,) " the water *trickling down the sides of the cave*, was

[1] *Reliquiæ Diluvianæ*, p. 144.
[2] Ibid. p. 50.
[3] Vol. i. p. 81, *note.*

" *forced* to ooze off laterally[1], at right angles from the " sides[2], *as soon as it came in contact with the mud*, above " which it then formed a *plate* or *crust*;" which operation must have been entirely independent of that which formed the *plate* or *crust* of stalagmite *beneath the mud*. This conclusion, will be found on examination to be altogether fallacious. The operation described, would no doubt have taken place *eventually*: but, it is evident, that the water, trickling down the sides of the cave, would, in the *first instance*, have insinuated itself *beneath a fluid sediment*, and would have gained the floor; and, retruding the loamy particles[3], and uniting and concreting its own homogeneous particles, would have formed " *partial deposits*" of stalagmite immediately on the subjacent face of the rock: until, *at length*, the gradual *condensation of the sediment* would have " forced" the stalagmitic incrustation to take place upon its surface, in the manner described by the hypothesis[4]; and thus, both would have been only varying and successive effects of the same cause, the same operation, and the same period of time. In other parts, where the water " *fell directly in drops from the roof*[5]," " stalagmitic accumulations were raised" upon the same sedimentary surface; but yet with a constant *tendency and effort to penetrate to the surface of the rock beneath*, by common hydrostatic gravitation: as is demonstrated, by the branches of stalagmite " *transfused bodily* through the " substance of the diluvial sediment," and by " the *sta-* " *lagmitic infiltrations* which percolate it[6]." The forma-

[1] *Reliquiæ Diluvianæ*, p. 11. [2] Ibid. p. 10.

[3] M. D'Hombre Firmas observes, of the loam in the Cavern of Durfort; " *that it does not incorporate itself with the stalagmite—le limon ne* " *s'incorpore pas avec les incrustations.*" *Biblioth. Univ.* Mai, 1821, p. 37.

[4] Both these operations appear to manifest themselves, in plate ii. fig. 2. B. C. of the *Reliq. Diluv.*

[5] *Reliquiæ Diluvianæ*, p. 11. [6] Ibid. p. 144.

tions *beneath* or *above* the mud, are therefore equally reconcilable with the *presence of the mud*, and must have depended absolutely and solely upon the *degree of the fluidity* of the latter; which was doubtless more fluid when the stalagmite began to be formed, and grew gradually more stiff, solid, and resisting. Thus, though there are no *alternations* of mud and stalagmite, yet, there are *two* partial strata of the same stalagmite inclosing and penetrating *one* stratum of mud; not of different periods, but which operated continually, though successively, in the same period; and therefore, I must further insist, that the "*chronological and historical inferences*" of detail, attempted to be drawn from the phenomena of those *two strata* respecting *four periods* of the cave, "*during the* "*second of which the cave* WAS *inhabited by hyænas*[1]," are not only not supported, but are contradicted by the phenomena; although the great general chronological inference piously and philosophically deduced, respecting the accordance of diluvial phenomena, with the date of the Mosaic deluge[2], remains unimpaired.

Mr. Professor Buckland is, with great reason, earnest to impress upon us the important results of his acute and laborious investigation of a *great diluvial current*, which he has distinctly traced *in a direction from the north, southward*[3], exhibiting "the effect of *retiring waters* cut-"ting out valleys in the table lands and sides of the "higher ridges, and covering them with gravel[4];" but, that current will in no manner affect the evidence of *previous transport from the south, northward*, as has been fully and distinctly shewn[5]. The *last great movement* of the sea in draining from its *old* to its *new* bed, must necessarily have proceeded *from the north*; and, any vestiges

[1] *Reliquiæ Diluvianæ*, p. 48. [2] Ibid. p. 51. [3] Ibid. p. 193, 198, 9.
[4] Ibid. p. 253, 4. [5] See above, p. 88—96.

of that movement which may remain on the earth's surface, would probably wear the simple character of a *current proceeding from the north;* but, let it be remembered, that *last progress* had been recently preceded by a *last reflux*[1]. The fossil remains of *southern* animals existing in *northern* soils, and the traces of a current proceeding from the *north* to the *south*, demonstrate *two opposite courses of the oceanic mass;* and confirm the alternate *refluxes* and *advances* of its waters, which we have deduced.

With respect to some minor points, in which Mr. Professor Buckland's hypothesis of an *antediluvian hyænas' den at Kirkdale* may find objections to the *diluvial transport of its animal contents*, and with respect to other difficulties which may yet perhaps occur, and which are to be referred rather to the impossibility of recovering or detecting every minute circumstance requisite to meet every imaginable objection, than to the force and solidity of the objections themselves, we have to set against all these, the *unanswerable objections* to the postulates and occult agencies which that *hypothesis* peremptorily requires for its establishment; and, since these are to be weighed collectively in a counterpoise against the former, we must without difficulty perceive, that they are overpowered by the preponderating determination of those objections.

Of the *three* main points of the argument of *transport from tropical regions* which I have here maintained, Mr. Professor Buckland's adverse argument grants the *two* which are chief and fundamental, viz. 1. *the action of the diluvial waters in transporting bodies of elephants, hippopotami, &c.*, as in the *Val d'Arno:* 2. *the universal action of those same waters,* "*over the whole globe.*" It is only the third and last point, viz. *the transport of those animals, by those waters, from tropical regions to northern latitudes,*

[1] See above, p. 265.

that he refuses to concede. And yet, this is much the *least point* of the three for him to grant: because, the two former supply all the *means* requisite for that transport, and he has acknowledged it to be "*probable that the climate was* "*warm where those animals lived;*" and we can find no solid reason whatever, historical or philosophical, for supposing that they ever lived out of the regions to which their species are *now restricted.* I have moreover shewn, by practical evidence, both, *why* they should have been conveyed *northward*[1], and also, the *speed* with which they might have been so conveyed[2]. *Wherefore*, then, does he refuse this third, and *least point*? Solely, on account of "*the phenomena of the cave at Kirkdale.*" And, *what* does he find in those phenomena to support his refusal? A difficulty of conceiving, *how* the remains of elephants, hippopotami, &c., could have been introduced into spaces, in the interior of a rock, actually smaller than their living bulk, without assuming, that the bones of the *hyænas* found among those of *elephants* prove, 1. that the former *devoured* the latter: and 2. that the former *divided the latter* and "*carried them piecemeal into the* "*inmost and smallest recesses of the cave.*" Had the cave, with all its attendant circumstances, occurred in *primitive rock*, as *granite*, then indeed there would have been a wide field for conjecture, and a heavy necessity for resorting to the *invention of hypothesis* to find a plausible solution of the difficulty; then, indeed, we must perforce have conceded to him his proposition,— "that the bones found within it, were lodged in the ca- "vities which contain them *at periods long subsequent to* "*the formation and consolidation of the strata in which the* "*cavity occurs.*" But, as soon as it is thoroughly ascertained, that the rock which incloses them is *not of primitive siliceous* but of *secondary calcareous formation*, a

[1] See above, p. 95. [2] Ibid. p. 97.

desiccated paste bearing the demonstration of its *former fluidity in a sea-bed;* as soon as it is further ascertained, that *all the rocks* in whose interior *similar animal accervations* have been discovered, are *of the same secondary formation;*—then, we refuse to concede his proposition; because all reason for making the concession is taken away, and all necessity of resorting to the improbable anomaly, that tropical animals once *lived* in the northern regions where their bones are *found*, ceases at once. The whole argument of the *hypothesis*, therefore, proceeds upon a ground that would have been absolutely necessary *if the rock had been primitive*, and it takes no account of the *essential difference* of the case actually before us; for, we are sure that *primitive rocks* were consolidated before animals existed, but, we are equally sure that *secondary rocks* have been consolidated long subsequently to the existence of animals, and, "that a "few years suffice to render the new consolidations un- "distinguishable from the most ancient[1]." The *consolidation of the Kirkdale limestone subsequently to the introduction of the animals within it*, is therefore to be maintained on principles infinitely sounder, more simple, more probable, and more strongly attested, than any which have been or can be adduced to shew, that *indigenous hyænas heretofore quartered indigenous elephants in the North Riding of Yorkshire;* which, nevertheless, constitutes the *essence*, nay, the *very vital principle of the hypothesis.*

Since then, on the admission of the Professor himself, —"the *rational idea* that the fossil *exuviæ* were driven "northward by the diluvial waters from the tropical "regions, can only be disproved by, and need only to be "abandoned on, the *authority afforded by* THE DEN *at* "*Kirkdale*," which *authority* can only arise from the *cer-*

[1] See above, p. 109.

tainty that the cave "WAS *once a den inhabited by hy-* " *ænas;*"—and, since we have found ample and sufficient reasons for assuring ourselves that it never was so, and never could have been so;—the "*rational idea of trans-* " *port*" must be admitted to be thoroughly established, not merely against the opposition attempted to be drawn from that alleged *authority*, but, by the testimony of the authority itself; more especially, as the exposition which has here been submitted did not enter into the contemplation of the scientific author of the hypothesis, and was therefore not included among the "*only adverse hypo-* " *theses which it occurred to him to propose*[1]." With this great question, therefore, thus previously solved, and with *the principles requisite for correctly interpreting the important geological phenomena*[2] thus ascertained; we may securely take all the benefit of the wonderful monument of diluvial power and destruction, unveiled to us in the *cave of Kirkdale* by the energy of its active explorer, and all the enjoyment of the stores of antediluvian antiquity which the *Reliquiæ Diluvianæ* has so liberally laid open to us, and for which our obligations are great to its pious, able, and attractive author.

Both of us seek the same common object, viz. the demonstration of the *truth* of the Mosaic record; but, to demonstrate that truth *effectually*, we must not be afraid to *probe it to the bottom*, (for it will *bear the probe*,) nor leave the *remote foundations* on which *every part* of it ultimately depends, *unexplored* and *unestablished*. I must therefore adventure to observe[3], with that respectful and reluctant

[1] *Reliquiæ Diluvianæ*, p. 39, 40; 77, 78; 96, 97.

[2] The reader will find those principles brought into their clearest illustration, by a collation of the geological phenomena revealed at Durfort and at Kösritz, with those manifested at Kirkdale. See Note [V.]

[3] " Nec verò hoc arroganter dictum existimari velim: nam *metalli-* " *carum rerum* scientiam concedens multis, quod est *geologiæ proprium*,

frankness which an upright mind will not regard as hostile in such a question, that, in advocating the cause of that invaluable truth, the eminent Professor of Mineralogy concedes *too much* to the authority of *the phenomena,* and *too little* to the authority of *the history; too much* to the *numerous revolutions* adventurously propounded by M. Cuvier[1],

" quoniam in eo studio ætatem consumpsi, si id mihi assumo, videor id " meo jure quodam modo vindicare." *Cic. Offic.* i. 1. (See above, p. 323.)

[1] " I must refer my readers to the ' *Ossemens Fossiles*' of Cuvier; a " work, containing more *sound and philosophical reasoning on the early* " *state of our planet,* and a more valuable collection of *authenticated facts* " *relating to the history of its fossil inhabitants,* than can be found in all " the books which have ever yet been written upon the subject." (*Reliq. Diluv.* p. 162. See also, *Vindic. Geolog.* p. 30, *note.*) This comprehensive eulogium, *truth* requires should be *divided:* the *latter* part, must indeed be unreservedly and gratefully confirmed by all, to this wonderful production of that illustrious and most extraordinary naturalist—" *anti-* " *quaire d'une espèce nouvelle,*" as he justly describes himself; but, the *former* part cannot, without the sacrifice of that which may not be sacrificed, be so unreservedly conceded. For, though he is led, by the acuteness and justness of his observations, to discern natural evidence of a *last revolution* corresponding generally to that confirmed by the Mosaic record, and to determine " *that this revolution buried and effaced the countries* " *which were before inhabited by men and the animal species now most* " *known, and that it laid dry the bed of the last sea and formed the coun-* " *tries at present inhabited:*" (*Disc. Prél.* p. 134, 135. *Theory,* &c. § 34.) in which last point he differs diametrically from the Professor; yet, he is hurried onward from thence, by unrestrained and unauthorised *invention,* to *suppose numerous preceding alternations of the same changes;* through defect of that *solid basis* to give and fix a settled foundation to his philosophy, which would assuredly have limited it to the *authenticated two,*— viz. *that which produced the receptacle of the former sea, now our land, and that which destroyed the former land, now our sea;* and would have restrained him from speaking with unmeasured confidence, of " the glory " of *restoring by means of a chronological order of the organic productions* " *of Nature, the history of the thousands of years which preceded the* " *existence of man, and of thousands of beings which were never his con-* " *temporaries.*" (Ibid. *in fin.*) He observes, that " *astronomy* has pro-

and *too little* to the *binary revolutions* lucidly indicated, and distinctly limited, by Moses.

We find the plural—"*revolutions*," applied by many pious writers to the antediluvian ages of the earth, with a freedom and familiarity perfectly astonishing; and with the same *technical license* with which a Greek or a Latin poet uses the *plural* for the *singular*, indifferently, to accommodate the necessities of his *metre*: not duly considering the importance of the *postulates* which that *plural* demands, or ascertaining the *reality of the facts* to which it awfully pledges

" ceeded much *faster* towards perfection than *geology*;" (Ibid. p. 2.—Ibid. § 1.) and he justly ascribes the tardiness of the latter to the neglect of " taking into consideration *all the conditions requisite for solving its* " *problem*." (Ibid. p. 24, 135.—Ibid. § 24.) And, what was the *essential condition* omitted? The testimony of his *fossil exuviæ*, " which *alone* " *can supply certainty in this question—eux seuls, en effet, donnent la* " *certitude*." (Ibid. p. 27.—Ibid. § 23.) But, he totally omits the *corrective condition, of a Revealed Record*. This last omission may, perhaps, be accounted *philosophical* in some countries; but, I trust, not so in *this land*, the soil of Bacon and of Newton. It is, indeed, the exclusion of *this last condition* from the problem, or only its partial and mutilated admission, that causes geology thus to come *limping after astronomy*; for, *astronomy stands on all its feet*, but, *geology does not whilst it excludes Revelation*. " Several of our geologists," says he, " resemble those histo- " rians who take no interest in the history of France except as to what " passed *before the time of Julius Cæsar*." (Ibid. p. 139.—Ibid. § 34. *in fin.*) And who are these? Why, they who *speculate* " respecting " the *origin of the world*." (Ibid.) He is justly sensible of *absurdity somewhere*, but he does not perceive *where* the absurdity lies. He does not discern, that it only lies in *speculating on the subject*; not, in *seeking the subject*. And, confounding the two, he considers that bright and governing epocha of all history, physical and moral, which displays the *immediate relation of our earth to the hand of its Creator*, as of parallel interest with the dull and nebulous history of Gaul *before it became known to the Romans*; by which confusion, far from evincing the " soundness of " his reasoning and philosophy," he only reveals the radical deficiencies in both. See Note [IV.] *On the numerous revolutions of M. Cuvier.*

the *responsibility of its employer*[1]. But, until we shall have thoroughly scrutinised and exhausted in our research — all the *possible effects* of the causes which operated in that *original rent and rupture* of a portion of the primitive globular surface that formed the *primitive sea-bed*, and that now produces all the sublime characters that distinguish *primordial mountain scenery*—all the *possible effects* of the *sea*

[1] "To *solve the difficulty*," says a pious but adventurous writer, "*we* "*must* CALL IN SOME GREAT REVOLUTION *more early than the flood*; by "which, unknown land animals, and unknown sea animals, and unknown vegetables, all at present in a fossil state, were lodged many "feet below the surface of those lands which we now inhabit. But, no "such revolution took place between the creation of man and the general "deluge. *Therefore*, the revolution *must* have taken place, and the "animals *must* have become extinct, at an epocha *anterior to the creation* "*of man*." (FABER *on the Three Dispensations*, vol. i. p. 122.) "*Several great revolutions must* have taken place in the course of the third, "and fourth, and fifth days." (Ibid. p. 134.) I must deny the occurrence of any such revolution between the creation of animals and vegetables and the creation of man, upon the *same authority* on which this learned writer denies its occurrence between the creation of man and the general deluge. The ground of denial is as solid for me, as it is for him; or, if it is not good for me, it is of no avail for him: for, the record, if duly examined and apprehended, is as distinct with respect to *time* before man's creation, as it is after it. The revolution which *he* cannot find between the creation of man and the deluge, and which he therefore *antedates* to the creation of man, *I* have shewn to have taken place *at the general deluge*, and to be no other than that *identical revolution*. And, where is the "*vasty deep*," from which we are entitled thus conveniently to "*call in revolutions*" at will, and to expect that they "*will come?*" *Is* it possible to be insensible of the millions of chances there must be, against any revolution we may so "*call in*" from our imagination having ever been *realised?* That "*vasty deep*," exists only in *artificial and mystical interpretations of the Mosaic Days of Creation*; which interpretations, I sincerely lament that the same pious and learned writer has thought it expedient to advocate, because he has thereby rendered it imperious, that his interpretations should be resolutely met, and effectually resisted. See Note [I.] *On the Mosaic Days of Creation.*

acting during sixteen centuries in its entire mass, both mechanically and chemically, on the soils and substances constituting the surface of that bed, which we *now occupy*. —all the *possible effects* of its violent discharge and transfusion, and the incalculable momentum of its branching progress excavating, accumulating, and dispersing the several materials of that surface,—and finally, all the *possible effects* of the *drying* of those materials saturated with a muriatic fluid, in their various substances, calcareous, argillaceous, saline, inflammable, &c., and of the combining powers of *air*, *heat*, and *fermentation* upon them all—until we shall have thoroughly scrutinised and exhausted the *possible effects of all those causes*, and shall at length arrive at effects for the production of which those causes are *manifestly and undeniably inadequate*; we shall not be justified, either by *philosophy* or *reason*, in resorting to any *third conjectural revolution*, however seductively urgent *imagination* may be to engage us not to listen to their admonitions and prohibitions.

I am, therefore, totally at a loss to understand what a most valuable and sound divine can intend to inculcate, where, in the liberality of his heart, he speaks of "the "*absurdity of supposing* that a literal interpretation of "terms in Scripture *ought to interfere with philosophical* "*inquiry*[1]." If the *truth of religion*, and the *truth of philosophy*, were *two different truths*, I could understand him; but, if they are *one and the same*—if there is, as I apprehend, *only one truth*—then I cannot understand him. He must certainly, therefore, have suppressed some *qualification* of his sentiment, which he gives credit to his readers for supplying. For, if a divine revelation has been *truly* imparted to man; if a correct literal interpretation of the terms of that *revelation* puts us in possession of any *certain and*

[1] Laudat. ap. *Vindic. Geolog.* p. 25.

fundamental facts relating to our globe, either in its *origin* or its *changes*, at the knowledge of which *philosophical inquiry* could never have arrived *by its own researches;* if it distinctly instructs us, that a *first earth perished*, overflowed with waters, and that it was *different from the earth which now is;* if it enables us to apprehend, distinctly, *two and only two universal revolutions* of the globe, the one *shortly before* the creation of animal and vegetable beings, the other *sixteen centuries subsequent to* their creation;—then, most assuredly, that literal interpretation *ought to interfere with philosophical inquiry*, if philosophical inquiry wishes to proceed by a rule of *truth*, and not by a rule of *error*. And, the first rational course for that philosophical inquiry to pursue is, undeniably; to collate the *existing monuments* with those *imparted facts*, before it permits itself any *conjectural excursion* which may draw it away into opposition to the secure instruction of those authoritative and accredited guides. Of the effect of the "*concessions on this point*" which the liberality of the same excellent divine inculcates, he must see with regret an example in the very able writer whose opinion Mr. Professor Buckland emphatically adduces, in evidence that "*a deluge has swept over every part of the globe;*" and who yet allows himself to affirm—"we have *no positive knowledge* to determine whether the deluge took "place *before or after the creation of man.* We have "*only* this negative evidence, that neither any part of a "human skeleton nor any implements of art have been "hitherto discovered, either in regular strata or in diluvian "detritus[1]." What becomes of *revelation*, if it is not to be accounted a source of positive evidence and determining knowledge upon *this head?* or, what "sublime discoveries "in *physics* can remunerate us" for the surrender or de-

[1] Greenough's *Geology*, p. 186.

preciation of the divine testimony which has *positively* determined that point? Is the *maximum* of positive knowledge which that testimony alone can supply, to sink into *negative knowledge* when contrasted with *physical evidence*? or, is *positive knowledge* to be so degraded as to be reduced to signify exclusively *physical evidence*? I am well persuaded that this valuable writer did not intend, in this allegation, to convey that *opposition to revelation* with which it must be received by every ill-affected mind, and, that he wrote it under some discrimination, in his own mind, between the spheres of *revelation* and of *physics;* but, still I ask, is such a discrimination *legitimate and valid in such a question*? or, if intended to be employed only *technically*, ought it to be expressed *absolutely* and without *qualification*? This great question, however, will be found to stand on ground very different from that on which it rested at the time when that observation was written; in the succeeding Note, *On the Recent Discovery of Fossil Human Remains.*

The estimable author of the *Reliquiæ Diluvianæ*, also, speaks in the *plural*—of "more early *revolutions*" than that of the deluge; and yet, I find the *only antecedent revolution* authenticated in the record, adequate to all the *effects* to which he thus indefinitely and *poetically* attributes a *plurality*. Certainly, the *binary revolutions* of Moses, will be found abundantly sufficient to unveil all the mystery of the *binary effects* pointed out by himself in the following acute and striking observation. "In strata "of *higher antiquity*, (than *diluvian*,) that have been "more shattered and disturbed by violent convulsions, "(i. e. in the *coal formation*, and also in *transition and* "*primitive rocks*,) irregularities of texture and disposition "in the strata on which the diluvian waters had to exert "their force, have caused the features of the valleys that "traverse them to be much less exclusively derivative

" from the simple action of a retiring flood of waters;
" and indeed have rendered the form, inclination, hard-
" ness, and relative position of the masses on which these
" waters had to operate, essential elements of any accurate
" calculations as to the quantity of effect that must be
" referred to them. Though *traces of diluvial action* are
" most unquestionably visible over the surface of the
" whole earth, we must not attribute the origin of *all*
" *valleys* exclusively to that action. In such cases as
" we have been describing, (*diluvial valleys,*) the simple
" force of *water* acting in mass is sufficient for the effects
" produced. But, in *other cases,* more especially in *moun-*
" *tain districts,* (*where the greatest disturbances appear*
" *generally to have taken place,*) the original form in
" which the strata were deposited, the subsequent con-
" vulsions to which they have been exposed, and the
" *fractures, elevations,* and *subsidences* which have affected
" them, have contributed to *produce valleys of various*
" *kinds on the surface of the earth, before it was submitted*
" *to that last catastrophe of an universal deluge, which has*
" *finally modified them all*[1]."

The *binary effects* here lucidly described, (as has been already shewn,) find their *adequate causes* only in the BINARY REVOLUTIONS which the Mosaic record alone reveals; in their *separate* and their *combined* operations; and, in the long and unceasing action of the sea upon its soils in the ages *intervening between those* TWO *revolutions*[2]. Under that exalted *authority,* we are able to trace

[1] *Reliquiæ Diluvianæ,* p. 258.

[2] " The science of Geology," says the cautious Dr. Macculloch, " is not yet sufficiently advanced to enable us — to pronounce on that " which is *anomaly* and that which is *law.* Should it be determined by " future investigations, that there are *essential disturbances among the* " PRIMARY ROCKS; *that* ONE, *or more revolutions, analogous to that* " *which appears to have occurred between the primary and secondary*

the true order of the several formations indicated by it or deducible from it, viz. *creative* — *fragmentary* — *sedimentary* — and *diluvial* — (answering to the — *primitive* — *intermediary* — *secondary* — and *tertiary* — of the mineral geology,) with a clearness and a security to which a *mere mineral* or *physical geology* could never have attained. There can be no reasonable doubt; that, if the *causes* which operated those several successive *productions* were duly considered and closely scrutinised, we should be enabled by them to expound the most important phenomena, for the explication of which the consciousness of physical insufficiency resorts to a *multiplicity* of inventive and unreal revolutions; and, that the point which M. Cuvier states to be "*the most important problem in geology*," would thereby be solved[1]. Thus, for example, the *inclined* and *vertical strata* will testify, that they must have acquired their present dispositions subsequently to that original rupture of the *primitive formations* which produced the *fragmentary*, and before those accumulations which constitute the present *flat formations:* that they must have been, originally, horizontal or flat like the latter, but that, after some centuries of the action of the sea upon and within their ruptured and loosened foundations, vast derangements and *failures* in those foundations brought them into their present irregular positions; and that, during the succeeding centuries, other *flat formations* were successively accumulated above them, which, on the retirement of the sea, remained in the

"*strata, have taken place in the* FORMER; *the present difficulty will* "*vanish.*" *Geol. Descr. of the West. Islands of Scotland*, vol. ii. p. 102. *Investigation alone* can never determine that *historical fact*, or decide whether the revolution was *one*, or *more than one;* yet, enough is admitted in this fair and wise declaration of *the sufficiency of* ONE *such authenticated revolution*, which reason will immediately confirm.

1 *Disc. Prélim.* p. 135.—*Theory*, § 84.

positions in which we now behold them. All these variations, evidently fall within the compass of the *two revolutions* of the record; and it requires but a little unprejudiced attention to perceive, that they result from *general causes indicated by those revolutions*. During the *primeval ages* in which the sea remained stationary, those *first strata* acquired a *gravitated consistency*, which they preserved after the derangement of the planes of the bases on which they had been formed, and to which they adhered; in them, therefore, we shall not be surprised to find shells different from those which, in an age long posterior, the violent passage of the ocean over its bed into a new basin, during the twelve months of its departing progress, brought and commixed with the loose soils of the *later strata*. We need no change in the *chemical nature of the sea* to account for this phenomenon, much less do we need a blind assumption, that different species of animals *succeeded each other in existence* at *different periods* according to those *chemical changes;* without any respect to *Creative Power*, which alone could have *originated* any one of them.

Our highly respected author, therefore, has been led, in his deference to the geological philosophy of M. Cuvier, to disallow much too far in geological practice, the just weight and perfect competency of the *record* for essaying and determining the equivocal, and often positively deceptious, suggestions of *phenomena*. This unequal (not to say unequitable) distribution of his confidence, appears to have originated in the precipitate assumption in the first instance, (an assumption, manifestly determined by a pious but too apprehensive jealousy for the credit of the record,) that he was obliged to *find time for natural operations in the* DAYS *recorded in the Mosaic history of Creation;* to which point he summarily, but with extreme caution, alludes in the second page of his *Reliquiæ Di-*

luvianæ, with reference to the thirty-second page of his *Vindiciæ Geologicæ*, coinciding so far with the position of Cuvier; "that *naturalists have succeeded* in causing "the *six days* of the creation to be considered as so many "*periods of indefinite length*[1]." "*Naturalists*," however, not being quite capacitated by their vocation to determine and establish the truth of this *consideration*, although they may have *succeeded in causing it to be adopted*, our scrupulous author calls in to his support the following "*words*" of the learned Bishop Horsley, which words he "deems *remarkable, and, in fact, admitting the whole of* "*that hypothesis*:—'That this revolution (*the Mosaic day*) 'was performed in the same space of time in the be-'ginning of the world and now, I could not over con-'fidently affirm[2].'" But, these "*words*" of that eminent Prelate will not appear so "*remarkable*" when it is

[1] *Disc. Prél.* p. 20.—*Theory of the Earth*, § 19. I must here take occasion to remark; that, although this great naturalist is pleased to concede—"that there is *no reason why we should not* ascribe the digest "of the book of Genesis to Moses himself—that we can by no means "doubt that it is the most ancient writing that our *western world* pos-"sesses—and, that the poetical traditions of the Greeks do not contra-"dict, but *admirably agree with* the annals of the Jews," &c.—yet, he regards EGYPT as the *parent* or *source* even of *religious civilisation*; alleging, "*that the Israelitish Colony went out of Egypt, to carry into* "*Palestine the sublime dogma of the Unity of God.*" (*Disc. Prél.* p. 82.) I would beg leave to ask him; *where* was that *sublime doctrine* in Egypt, when HE who, ages before, had been worshipped in *His Unity* in Palestine by the forefathers of that "*Israelitish Colony—peuplade* "*Israélite*," pronounced to that same Moses—"*against all the* GODS *of* "*Egypt I will execute judgment*: I AM THE LORD?" If such notions of early history are *philosophical*, the *philosophy* must consist, not in seeing *farther*, but in not seeing *so far* as others; it will not impose upon us here.

[2] *Vindiciæ Geologicæ*, p. 32.

further considered, that they proceeded from his admitting the doctrine of Bishop Patrick's *Christian Chaos*[1]; although he prudently abstains from all defence or discussion of that desperate and insanable doctrine.

Whereas, *each* of those *six Mosaic days* was designed to be *successively and specially signalized, and impressed upon the human sense, by* ORIGINAL ACTS *of God's almighty power, exercised without time, and antecedently to the commencement of all natural operations,* (as Bacon has truly pronounced, and as the concordant tenor of both Scriptures positively confirms,) for the *solid, conspicuous,* and *unequivocal* establishment of the *basis* of our religious *knowledge* and *belief*—ινα ημας προαγαγη τω Θεω, "*that it* "*might* BRING US TO GOD." And therefore, as I have amply shewn in the first and second parts of the preceding work, there can be no defensible reason for maintaining the opposite assumption, or the ulterior assumptive and poetical inferences of "*a series of revolutions*" and "*previous worlds,*" but, on the contrary, the strongest reason possible for "discarding them[2];" as fraught with *most real,* though perhaps *latent* danger to religion, by obscuring the *conspicuity* of that basis, and thereby rendering its solidity *equivocal:* and by throwing back indefinitely into time our apprehension of the *immediate action* of Omnipotence, and thereby *counteracting our approximation to it:* as the *history of physical science* for more than a century past has miserably and reproachfully demonstrated.

We have heard of a man who, in a dark night, stumbled at the brink of a precipice, but had the good fortune to save himself by his hands; and, though he was unable to regain the surface, he yet succeeded in keeping

[1] See above, vol. i. p. 194.

[2] *Vindiciæ Geologicæ,* p. 33.

himself hanging till morning. Difficult and painful as was the effort of remaining so long suspended, yet, increasing apprehension of the *viewless profundity* supplied the strength and patience requisite for the awful occasion. Hundreds of feet *might be* stretching beneath him; rocks, or a watery gulf, *might be* waiting to receive him. The first infusion of *light*, however, shewed him that his feet were *within an inch of the ground.* Of the same nature is that *space of undistinguishable distance*, in which the imagination of the Mineral Geology fabricates its *indefinite periods and epochas of nature*, its *numerous revolutions*, and its *previous worlds:* one ray of *light* infused from THE SOURCE, shews it that it is actually *at the termination of time*[1], *à parte ante.*

As much as it is necessary to know the extent of the power of *any agent*, before we can philosophically or rationally assign it as the *cause* of an *effect*, so much is it unquestionably necessary to know the extent of the power of *that agent* to which we so familiarly but so unintelligently apply the term of "*Nature*"—*sine mente sonus*—before we can with *true philosophy*, or indeed with *common sense*, allege it as a *cause.* We know and are perfectly sure, that it *could not have commenced any operation* until it had first *been made to act;* and therefore, in assigning to it *remote effects*, it is indispensably necessary to trace back the *epocha* when it was *first made to act:* lest we should ascribe to it operations of *too early a date*, and, by our *anachronism*, lay a false foundation in science which must render false the whole superstructure we would raise upon it. That *epocha*, we can ascertain with perfect certitude by the aid of the *Mosaical Revelation;* indeed, if we could not, that revelation would be truncated of its *root.* But, the *Mineral Geology* can

[1] See above, *the definition of time*, vol. i. p. 182.

never ascertain it by the utmost exertion of its own separate resources; and it is because it has persisted in attempting to do so, that it has laid for itself that *foundation of anachronism* that ascribes to the "*action of* "*Nature,*" effects which were produced before *the commencement of its operation.* Such "*Nature,*" is only a *veil* introduced by tacit agreement amongst the administrators of *Physical Mysteries,* to spare intellectual pride the humiliation of a mutual recognition of absolute ignorance. It is, at best, only another term for an *occult cause;* and, "*occult qualities,*" said Newton, "*are not to be admitted* "*in experimental philosophy.*" And, who is more highly gifted for the great and salutary work of overruling and rectifying those pernicious and inveterate aberrations in philosophy and science, than he who has had the proud and distinguished honour of being the FIRST to lay the science of GEOLOGY amongst us, publicly and academically, upon the foundation of that divine principle of Newton—"*de* "DEO *ex* PHÆNOMENIS *disserere, ad* PHILOSOPHIAM "NATURALEM *pertinet*[1]?"—"*it pertains to Natural* "*Philosophy, to reason from phenomena to* GOD:" a principle, which is not to stand an insulated and barren proposition, but, to be made to deliver out effectually all its train of connected consequences, in parallel adaptation both to *Natural Philosophy* and to *Revelation.*

To return now to the argument, and to conclude. Since, according to the assumptions of the complicated hypothesis *of a change of climate in the northern latitudes, which has rendered them no longer congenial to elephants, hyænas,* &c., —the *external* relations of the earth in the solar system must have been *changed,* of which *change* we possess no kind of evidence whatever, *physical, moral,* or *historical;* whereas, according to the simple argument

[1] See above, vol. i. p. 61, *note.*

which has been here drawn out *in evidence of diluvial transport from tropical regions*—the *change* took place only in the *internal* relations of its parts, of which *change* we have assembled an host of the most powerful and consentient witnesses, of all those three descriptions; we cannot, if we are careful to keep the balance of our reason clear from all adventitious bias of *hypothetical incrustation*, fail to perceive that scale preponderate, in which are accumulated the arguments confirming *a change in the internal relations only*, and therefore, confirming "*the rational* "*idea of the* TRANSPORT *of animal bodies by the diluvial* "*waters from tropical regions*;" and, confirming also that "INTERCHANGE *of the surfaces occupied respectively by* "*land and water*, which many writers of high authority "have conceived to have immediately succeeded," or rather, to have been immediately effected by, "*the last* "*great geological revolution of our globe*," or, *the last of the* BINARY REVOLUTIONS *revealed to our diligent investigation, in the* DIVINE RECORD *imparted to us through* MOSES.

* * * * * * * * * * * * *

HAVING had occasion to advert, in a note at p. 303, to the measures taken by my enterprising friend, Captain De Capell Brooke, to procure specimens of the *remains of whale* reported to lie on the summit of the mountain of Sandhorn or Sandholm in Norway; of which native of the ocean, remains were also affirmed to lie on the summits of the North Fugelöe, and Western Stappen Rock, in Finmark; I here insert, by permission of Captain Brooke, a communication, dated the 11th of August, 1824, which he has just received (May 6, 1825) relative to the object of his inquiry.

" *Giesvæhr, 11th Aug.* 1824.

" Sir,

" Your esteemed favour dated London, May 1st, duly " reached us on the 30th of June; in conformity to which, I had two " experiments made to ascend the top of the Westernmost Stappen, in " order to ascertain, whether there were really any remains of *whale* " *bones*, as reported by people who are still in existence, and willing to " make affidavit that, no further back than 30 years, they saw there the " remains of the *vertebræ of a whale-fish*. In the first experiment that " was made, we could not dig deeper than four inches in the ground; in " consequence of the ground being frozen. The second, was more for- " tunate; we dug to the depth of three feet, when we found the two " specimens which accompany the present; the rest, were so deteriorated " by lying under the ground so long, that they crumbled when touched. " The pebbles or small stones, which also accompany this, were in the soil " where the bones were deposited; as well as some of the earth, and " two pieces of the solid rock which were broken off. On the summit, " there was no mould or clay to be found. The height from high-water " mark to where these remains of *whale-bones* were found, is about *eight-* " *hundred feet*. A further examination of this matter could not be " made. I had wished to superintend this myself, but was prevented " by illness.

" I am, Dear Sir, &c.

(Signed) " S. Kjelsberg."

Translated from the Norwegian.

The specimens above mentioned, were forwarded for England; Mr. Crowe, of Hammerfest, accompanying them from Tromsöe in Finmark. Unfortunately, during a tremendous gale on the night of the 24th of December, he was totally shipwrecked on the Norway coast, when crossing the Polar circle, and near the Island of Trænen; the crew escaping only with their lives.

Further measures, however, have been taken, to insure the success of the research; instructions having been sent out by Captain Brooke to collect fresh specimens from the Stappen Rock, as also others from the summits of the N. Fugelöe, and of Sandhorn. Mr. Crowe's long experience in the northern seas, enabled him to ascertain by inspection, that the specimens, which have unfortunately been lost, were really *bone of whale*.

NOTES.

NOTE [IV.]

On the Numerous Revolutions of M. Le Baron CUVIER.

THE ultimate ground of the *plurality of revolutions of the globe* propounded by M. Cuvier, which constitutes the *basis of his geology*, is declared in the second volume of his *Recherches sur les Ossemens Fossiles;* where he treats, in conjunction with M. Brogniart, of the animal remains discovered in the soils of Paris. He there finds *gypsum* and certain other soils separating, and alternating with, soils which he recognises to be of *marine* or *salt-water formation;* but he affirms, that the *gypsum* and those other soils are of *fresh-water formation;* and from thence he concludes, definitively, that there must have been *as many revolutions of the earth* as he can detect evidences of these *two distinct and alternating formations.*

But, what is M. Cuvier's *certain proof* that *gypsum* is a soil of *fresh-water formation*, and not of *salt-water* like the marine limestone on which it immediately lies[1]? It is, that *a few fresh-water shells* have been found in it[2]—"*en bien*

[1] "Le terrain *gypseux* est placé immédiatement au-dessus du *calcaire* "*marin*, et il n'est pas possible de douter de cette superposition." *Ossemens Fossiles*, tom. ii. p. 278.

[2] "From these facts M. Brogniart inferred, that these beds *de-*"*monstrated* the repeated alternations of sea and of fresh water on the "same tract.—But, whilst forming these opinions, M. Brogniart *found* "*it necessary to admit* that the formation of gypsum *might* also have

" *petite quantité,*" says M. D'Aubuisson [1]. M. Cuvier ad-
" mits, that they are *very rare;*" but he adds—" *one single*
" *such shell,* if not accompanied with *sea-shells,* would suffice
" to demonstrate *the truth of the opinion of Lamanon* and
" some other naturalists, who had already thought, before
" us, that the *gypsa* of Montmartre and of the other hills
" of the basin of Paris, *had crystallised themselves in* LAKES
" OF FRESH-WATER [2]." Hence M. Cuvier lays down the position; " that it is in these *fresh-water lakes* that the
" *gypsa* of Paris have formed themselves [3];" and he observes, " This stone, *formed in fresh-water,* which was
" almost overlooked by, or unknown to, geologists, ap-
" pears to us one of the newest results of our researches [4]."

" taken place both in fresh and salt water. — Brogniart and
" Cuvier had founded their opinion of the *fresh-water origin* of the
" upper beds of *gypsum,* chiefly on the presence of *a shell* found in the
" gypsum, which appeared to be a *Cyclostoma,* and was *supposed* to be
" a fresh-water shell. Of these shells *two only* were found in the
" gypsum; *one* of which, in the possession of Brogniart, had its mouth
" unluckily concealed; but the *other,* in the possession of Faujas
" St. Fond, as fortunately, had it displayed so as to shew that it
" agreed with *Cyclostoma mumia* of Lamarck, who had only named it
" so provisionally, since, from its thickness, he had supposed it to be a
" sea-shell. M. Brard hence concludes, that the *fresh-water origin of*
" *gypsum does not derive any support from this shell.*"—PARKINSON, *Foss. Org. Rem.* p. 255, and 259.

[1] *Traité de Géognosie,* tom. ii. p. 416.

[2] " *Une seule suffiroit,* quand elle n'est point accompagnée de
" coquilles *marines,* pour démontrer la vérité de *l'opinion de Lamanon*
" et de quelques autres naturalistes, qui, déjà avant nous, avoient pensé
" que les *gypses* de Montmartre et des autres collines du bassin de Paris,
" *se sont cristalisées dans* DES LACS D'EAU DOUCE." *Ossemens Fossiles,* tom. ii. p. 281.

[3] " C'est dans *ces lacs* que se sont formés *nos gypses.*" Ib. p. 233.

[4] " Cette pierre, *formée dans l'eau douce,* qui étoit presqu'oubliée ou
" inconnue des géologistes, nous paroît un des résultats les plus neufs de
" nos recherches." Ib. *ib.*

The *evidence of the fresh-water shell*, we will consider hereafter; at present, let us attend to this *alleged opinion of Lamanon*, and to the *geological character of gypsum*.

"With respect to the soils of the environs of Paris" (says the cautious and sagacious M. D'Aubuisson, who has no *theory* to establish in the question,) "where we "see an alternation and *even a mixture* of beings of both "classes (*sea-shells, and fresh-water shells*); this is one "of those particular cases, for the solution of which *we* "*have not sufficient data*. I shall confine myself to the "calling to recollection, that *Lamanon*, one of the un- "fortunate companions of la Peyrouse, taking into con- "sideration the nature of the animals contained in the "*gypseous formation* of Paris, regarded it *as having de-* "*posited itself in a* GREAT LAKE *which* THE SEA *had left* "*upon the continent at the time of its retreat; the water of* "*which* LOST ITS SALTNESS, *by little and little, through* "*the continual affluence of fresh-waters*[1]."

How differently is this opinion of Lamanon qualified, as it relates to the *origin of gypsum*, when thus stated *at length*[2], from what it appears to be, in the *curtailed form* just before quoted from M. Cuvier? By that curtailment, all *relation of gypsum to salt-water* is put out of sight; and the mind, instead of being enabled to form its own rational

[1] "Je me bornerai seulement à rappeler, que Lamanon, un des in- "fortunés compagnons de la Peyrouse, prenant en considération la "nature des animaux renfermés dans la *formation gypseuse* de Paris, "la regardait *comme s'étant déposée dans un* GRAND LAC *que* LA MER *avait* "*laissé sur le continent lors de sa retraite, et dont l'eau avait perdu peu-* "*à-peu sa* SALURE *par l'affluence continuelle des eaux douces.*" *Traité de Géognosie*, tom. ii. p. 426.

[2] This *full statement* will also serve to rectify that of M. Humboldt, where he says: "The *gypsum with bones* of Montmartre, which Karsten "considered as analogous to the *saliferous gypsum* of zechstein, had been "considered by Lamanon and M. Voight (1790) as a deposite from "*fresh-water.*" *Superp. of Rocks*, p. 384.

deductions, is necessarily seduced into the previous conclusions of the *hypothetist*. Let us therefore consider the geological character of *gypsum*.

"*Gypsum*," says M. D'Aubuisson, "is almost always "accompanied by *rock-salt* in secondary soils, as well as "in those of which we have already spoken; and it is ex- "tremely rare, to find any masses of the *latter mineral* "which are not accompanied by *gypsum: these two rocks* "*are intimately allied by geognostic relation*[1], and we "shall treat of them *in conjunction*.—We shall distinguish "only *two* formations; that of the gypsum of *Alpine* "*limestone*, and that of the gypsum of *second sand-stone;* "and we shall moreover remark, that these are not so "much different formations, as remarkable members of "the two formations already described[2]."

"*Gypsum of Alpine limestone.*

"— There arise out of the great *gypsum* districts of "this formation, *salt-springs* more or less numerous, and "more or less rich in salt; an incontestable proof that "these soils *contain salt*. But, that which is remarkable "is, that this mineral is not found there in a visible form, "the mass is only *impregnated with it*. It is thus, that "in Thuringia, notwithstanding the numerous subter- "ranean works which traverse the soil in every direction, "the discovery of a few grains or veins of salt by the "miners, is mentioned as a phenomenon; and yet, in all "this country, according to the report of M. Charpentier "(the elder), all the *springs* are more or less *salt*, and "some to such a degree as to give occasion to several im- "portant salt-works. We think that we may refer to the

[1] This position, is thoroughly confirmed by M. Humboldt's statistical statements. *Superp. of Rocks*, p. 311—323.

[2] *Traité de Géognosie*, tom. ii. p. 386, 389.

" *gypseous* formation of Alpine limestone, the *salt-spring*
" of the small town of Salies in Béarn; which furnishes
" two cubic *mètres* of water *per* hour, and about three
" quintals and half of salt *per* cubic *mètre*[1]. (18 *per*
" cent.)

" *Gypsum of sand-stone with clay. Saltzformation of*
" *Werner.*

" The greatest masses of *salt* which we know, are
" found in the middle of strata of *clay* and *gypsum*,
" between the first limestone formation, the Alpine, and
" the second sand-stone formation, or *sand-stone with*
" *clay*[2].—

" Let us now proceed to *rock-salt*; and let us consider
" some of the great *saliferous masses*, the nature and posi-
" tion of which have been the object of the examination
" of geologists. The greatest of the *deposits of salt* which
" we know, is that which is found at the foot of the *Monts*
" *Crapacs*, and which, under the form of a large belt
" (*bande*), traverses Poland and Transylvania.—It consists
" of *clay* and *gypsum* containing masses or flattened heaps
" of *salt*[3].—This deposit contains *marine shells*, even in
" the masses of *salt*[4].—

" The Alps of the Tyrol, of Salzburg, and of Austria,
" present to us, though at a very different level, a deposit
" nearly similar of *saliferous gypsum and clay*, and which
" is also exceedingly productive.—Two examples will
" give an idea of this deposit: upon the *Salzberg* (i. e.
" *mountain of salt*), to the east of Berchtolsgaden, in the
" country of Salzburg, is, according to M. de Buch, the
" greatest mass of *rock-salt* known in Germany.—Its roof
" consists of a stratum of *gypsum* of sixty *mètres* in thick-
" ness.—Two leagues further is the great *saliferous mass*

[1] *Traité de Géognosie*, tom. ii. p. 392.
[2] Ibid. p. 393.
[3] Ibid. p. 394.
[4] Ibid. p. 395.

" of Hallein.—It consists of a schistous and greenish " clay more or less impregnated with *muriate*, and con- " taining small veins of crystallised salt which are some- " times of several *mètres* in length.—This mass appears " to be joined to that of Berchtolsgaden; from which it " is separated by *gypseous* mountains which are probably " a part of that formation.—To the same formation I am " inclined to refer, with Mr. Buckland, the strata of *rock-* " *salt* which the county of Chester in England contains, " in the middle of the formation of *red-marl* which has so " near a relation to the *sand-stone with clay* of Thuringia[1]. " —M. de Charpentier, director of the mines and salt- " works at Bex, thinks that the *saliferous gypsum* of that " country is in strata in an intermediate (*transition*) lime- " stone very argillaceous and carburetted[2].

" The *gypsum* and *rock-salt* are found also in soils " long posterior to the sand-stone with clay.—We have " seen, that M. Steffens considers the *gypsa* of Lower " Germany as making part of the chalky formation; " and the *salt-waters*, which issue in that country, are " referred to these *gypsa* and to the *salt* which they con- " tain[3]."

Now, is it not somewhat remarkable, that M. Cuvier, in laying the foundation of his *system of numerous revolutions* in the *nature of gypsum*, which substance *that system requires to be a fresh-water formation;* although he enters largely into its description with relation to *all other soils*, yet takes no notice of its relation to *salt*, to which M. D'Aubuisson shews that it is " *intimately allied by* " *geognostic relation*?" and that, in appropriating and stating the observation of Lamanon, he should omit that part of it which points out *an original relation of the gypsum to the water of the* SEA? These notable *exclusions*,

[1] *Traité de Géognosie*, tom. ii. p. 396—398.
[2] Ibid. p. 249. [3] Ibid. p. 401.

appear to betoken, very strongly, the sensitive apprehension of *hypothesis*. But, if *salt* is almost universally connected with *gypsum*, so as to evince an *intimate geognostic relation between the two*; and if, in the particular cases of the basin of Paris, &c. it is not actually found with it; science is not authorised to conclude from thence, that this *particular gypsum* had an origin different from *gypsum in general*, but is enjoined by reason to inquire, from *what cause* and by *what means* it has become *disunited*, in these instances, *from the salt with which it must have been originally associated?* The generally constant presence of *salt* with *gypsum*, notwithstanding some *particular exceptions*, is a far more direct and convincing evidence of the *gypsum* not being a *fresh-water formation*, than any that can be deduced from the presence of *equivocal shells*: it is *conclusive*, against their hypothetical testimony in any numbers. It certifies, that, whilst the *gypsum* remained in its primitive fluid state, the water which held it in solution was not a *fresh-water* but a *water positively saline*; so that the shells found in it, must either have lived in that water, or must have been accidentally and mechanically conveyed into it: and further, that if the *salt* has disappeared from the *basin of Paris*, it must have been *washed entirely away* from the *limited and insulated masses of gypsum* which that basin contains[1], previously to the perfect consolidation of the *gypsum*, by the long continued absorption and percolation of the *fresh-waters of rains*, which, by little and little, according to the opinion of Lamanon, caused it to "*lose its saltness.*" But, the *gypsum* will not therefore be a *fresh-water formation*, but a true *salt-water formation*; if that term relates, as it should relate, to *essence* and *origin*, and not to *circumstance and accident*.

[1] *Ossemens Fossiles*, tom. ii. p. 244. *Traité de Géogn.* tom. ii. p. 408.

M. Cuvier would obviate this argument, by alleging, "that the *gypseous soil* of Paris cannot be *exactly referred* "to any of the formations described by *M. Werner, or* "*by his disciples*[1]." But, this allegation will not have power to turn the point of the argument. That the *gypsum of Paris* differs in *circumstance* from those extended formations, is evident; but, there is no ground of evidence whatever, that it differs in *nature, origin,* or *substance.* The *entire opinion* of Lamanon, bears the contrary way. Since that *gypsum* holds by its *general nature* to all other *gypsa,* the peculiarities which may attend its position in the basin of Paris, only indicate the effects of its subjection to *local and accidental causes;* and therefore, no *essential difference* is pointed out by stating, that it is not "*exactly referrible*" to the great gypseous formations described to us by that sagacious "*disciple of Werner,*" M. D'Aubuisson.

To bring the whole question of M. Cuvier's *Numerous Revolutions* to a point before the reader, and to present it summarily, yet distinctly and entirely to his intelligence, so that he may not think it necessary to reserve in his mind any *doubt, expectation,* or *suspicion,* that there is *more in the argument than there really is;* I shall here produce that eminent naturalist's *statements* respecting the different formations which compose the soil of Paris and its vicinity, and also, the conclusions which he deduces from them, in order to establish his *numerous revolutions.*

"We may represent to ourselves the materials which "compose the basin of Paris within the limits that we

[1] "Nous devons rappeler ici ce que l'un de nous a dit ailleurs, "(*Brongniart, Traité Elément. de Minéralogie,* tom. i. p. 177.) c'est que "le térrain gypseux des environs de Paris ne peut *se rapporter exacte-* "*ment* à aucune des formations décrites *par M. Werner ou par ses dis-* "*ciples.*" *Ossemens Fossiles,* tom. ii. p. 286.

" have assigned to it[1], as having been deposited *in a vast* " *hollow space*, a sort of *gulf*, the sides of which are of " *chalk*.

" This gulf formed, perhaps, an entire circle, a sort of " great lake; but we cannot be certain of it, because the " S.W. sides, as well as the materials which they con- " tained, have been covered over by the great *plateau* of " sand of which we first spoke."—

" We shall first describe the *chalk*, the most ancient " of the materials which we have in our vicinity.

" We shall conclude with the *sandy plateau*, the new- " est (or *last*) of our geological products.

" We shall treat, between these *two extremes*, of the " less extended but more varied materials, which had " filled up the great cavity of chalk before the *plateau* of " sand deposited itself equally over them all.

" These materials may be divided into *two stages*:

" 1. The *first*, which covers the chalk in all parts " where it was not too much elevated, and which has " filled all the bottom of the gulf, subdivides itself into " *two parts*, nearly equal in level, and which, appearing " seldom together, seem to be in a manner placed, not one " upon the other, but *end to end*: *viz.* the *plateau* of sili- " ceous limestone, almost always *without shells*, and the " *plateau* of coarse limestone (*grossier*), *containing shells*.

" We are sufficiently acquainted with the limits of " *this stage* on the side of the *chalk*, because this soil is " not again found above it; but, these same limits are " again masked in many places by the *second stage*, and by " the great *sandy plateau* which forms the *third*, and " which covers a great part of the *other two*.

[1] Those limits are thus briefly presented by D'Aubuisson. tom. ii. p. 404. " Extending north, to Senlis and Laon; east, to Rheims and " Epernay; south, to Orleans; and west, to Chartres and Mantes."

" 2. The *second stage*, is formed of *gypsum* and *marl*. " It is not spread generally, but only from space to space; " and, as it were, *in spots;* which spots, at the same time, " are very different from each other, in their thickness " and in the details of their composition.

" These two *intermediate stages*, (i. e. *between the chalk* " *below, and the sand above*,) as well as the two *extreme* " *stages*, (i. e. *the chalk and the sand*,) are covered, and " all the hollows or interstices which they have left are " partly filled, by another kind of soil mixed also with " *marl* and *silex;* and which we call *the last fresh-water* " *soil*, because it swarms with *fresh-water shells only*.

" Such are the great masses of which our district is " composed, and which form the different stages. But, " in *subdividing each stage*, we can arrive at still greater " precision; and we obtain more rigorous mineralogical " determinations, which yield as many as *nine distinct* " *kinds of strata*, of which we shall first present the enu- " meration, and afterwards, the distinctive characters.

Enumeration of the different sorts of soils, or formations, *which constitute the soil of the neighbourhood of Paris.*

SOIL OF MIDDLE SEDIMENT.

Formations.		*Sub-formations, and principal rocks which compose them.*
I. Ancient *marine* soil.	1.	Chalk.

SOIL OF UPPER SEDIMENT.

II. First *fresh-water* soil.	2.	Plastic clay. Lignites. First sand-stone.
III. First *marine* soil.	3.	Coarse limestone, and the sand-stone which it often contains.

Formations.	*Subformations, and principal rocks which compose them.*
IV. Second *fresh-water* soil.	4. Siliceous limestone. 5. Gypsum with bones. Fresh-water marls.
V. Second *marine* soil.	6. Marine gypseous marls. 7. Third sand-stone, and sea-sand above it. Limestone, and marine marls above it.
VI. Third and last *fresh-water* soil[1].	8. *Meulières*, without shells. *Meulières*, with shells. Fresh-water marls above.
VII. Soil of transport and of alluvion.	9. Rolled pebbles and ancient pudding-stone. *Ancient and modern alluvial mud.* Black argillaceous marls, and peat (*tourbes*).

" We here think it proper, to indicate the *place* that " the soils of Paris hold in the *divisions* which we seem " authorised to acknowledge and establish in the *different soils which compose the crust of the globe.*

" After the great division of the ancient or *primordial* " soils, composed generally of rocks *formed by confused* " *crystallisation*[2], such as granite, porphyry, statuary " marbles, shining schists, &c. which division compre-

[1] " This *terminology*, (observes Humboldt), decides perhaps *some-* " *what too much* on the alternation of fresh and salt-water.—Positive " geognosy does not pronounce on the nature of the *liquids* in which it is " said that the deposits were formed; those *waters of granite, porphyry,* " and *gypsum*, which in *hypothetic geology*, are made *to arrive tide by* " *tide on the same point of the globe.*" *Superp. of Rocks*, p. 63 and 67.

[2] Of the *formation* of primordial rock by *chemical crystallisation*, see above, vol. i. p. 86, and the argument which precedes and follows.

" hends the earths named *primitive* and *of transition*;
" comes the *second great division*, which embraces the
" earths formed by *sediment*, and which have been called
" *sedimentary soils*. We subdivide these last into *three*
" *classes*, to which we may assign the following *limits* and
" *names*.

" 1. The soils of *inferior* or *lowest sediment*, which
" extend from the last transition rocks to the limestone
" containing *gryphites*, inclusively. These comprise espe-
" cially, the *coal formation*, the *Alpine limestone*, and the
" *red sand-stone*.

" II. The soils of *middle sediment*, which extend from
" the preceding limestone and red sand-stone to *above the*
" *chalk*. These chiefly comprehend the *Jura limestone*,
" compact, whitish, and oolithic.

" III. The soils of *upper sediment*, named also *tertiary*
" *soils*, extend from the chalk exclusively, or from the
" plastic clay and *lignites* inclusively, to the surface of
" the earth, or rather, to the *last marine deposits of the*
" *ancient sea*.

" This *last class*, to which pertains the greatest part
" of the soil of the basin of Paris and a great number of
" other soils spread over the whole surface of the globe,
" was almost entirely unknown to the geologists of the
" celebrated *school of Freyberg* (i. e. *of Werner*). It
" therefore became necessary for us to give to these soils
" particular denominations, and such as should furnish to
" naturalists the means of designating them with pre-
" cision[1].

Now, " in resuming the strata before enumerated from
" the chalk," proceeds M. Cuvier, " *we represent to our-*
" *selves in the first place—on se représente d'abord*[2]—a *sea*
" which deposits on its bottom an immense mass of *chalk*,

[1] *Ossemens Fossiles*, tom. ii. p. 243—245, and note.

[2] See above, vol. i. p. 89, note.

" and of *molluscæ* of particular species. This *precipi-*
" *tation* of chalk, and the shells which accompany it,
" cease on a sudden; the *sea retires; waters of another*
" *nature, very probably analogous to that of our fresh-*
" *waters*, succeed to it, and all the cavities of the marine
" soil are filled up with clay, remnants of terrestrial vege-
" tables, and of those shells which live in *fresh-waters*.
" But presently, *another sea, producing new*[1] *inhabitants*,
" nourishing a prodigious quantity of testaceous *molluscæ*,
" all different from those in the chalk, *returns* to cover
" the clay, its *lignites*, and their shells, and deposits upon
" this bottom vast banks, composed in a great part of the
" testaceous *exuviæ* of these new *molluscæ*. By little and
" little this production of shells also diminishes, and
" ceases altogether; the *sea retires*, and the surface is
" covered with lakes of *fresh-water;* alternate beds of
" *gypsum* and *marl* form themselves, which envelope both
" the remnants of the animals which lived in these lakes,
" and the bones of those which lived on their borders.
" The *sea returns again;* it first *nourishes* some species
" of bivalve and turbinated shells. These shells disap-
" pear, and are *replaced by oysters*[2]. An *interval of time*
" *then passes*, during which a great mass of sand deposits
" itself. *We must believe—on doit croire*—either that no
" organised body lived during this period in that sea, or,
" that their *exuviæ* have been entirely destroyed; for, we
" find no remnants (*débris*) in this sand; but, the varied
" *productions of this third sea* reappear, and we again find
" on the summits of Montmartre, of Romainville, of the
" hill of Nanteuil-le-Haudouin, &c., the *same shells* that
" were found in the marls above the gypsum, and which,
" although *really different* from those of the coarse lime-
" stone, have yet a *great resemblance to them*.

" At length, the *sea retires altogether* for the *third* time;

[1] How "*producing new*?" See above, p. 211. [2] Again I ask, *how*?

" lakes or pools *of fresh-water* replace it, and cover, to-
" gether with the remnants of their inhabitants, almost
" all the summits of the lesser hills (*côteaux*), and even
" the surfaces of some of the plains that separate them[1]."

In these passages, the whole mystery of M. Cuvier's *numerous revolutions*, as they stand opposed to the *binary revolutions* of the Mosaic record, is unveiled; and is laid open, in its *lowest foundation*, to the cognisance and scrutiny of every common reader.

This ingeniously compacted structure has, at first sight, a plausible *historical* appearance, sufficiently so to secure a reception amongst all persons who are disposed to take statements and conclusions upon trust, and who spare themselves the trouble of investigating for themselves; but, those who are more wary and rigorous as to what they admit into their minds for *truth*, and who insist upon applying the test of that severe criterion, will discover the most solid reasons for dissenting totally from the graphical and sanguine inventor. These will find, in this romantic exposition which presents to us alternating *sea-water* and *fresh-water* floods, *producing different races of animals* in different and distant *periods* of the earth, (without any reference to *creative operation* and therefore we must suppose by *equivocal generation*, and without the most transient respect to a *revealed testimony*,) all the proper characters of a *waking dream;* they will discern, that it does not exhibit a true philosophical *chain* of physical causes and effects; but, to speak technically, a confused *breccia of mineralogical ideas*, artificially cemented by *system* into the form in which it is presented to us. The whole of this scheme which we are called upon to "*represent to ourselves*," and which we may "*represent to ourselves*", without making one single step of approximation to *fact* and *reality*, is, as we have seen, *founded* on an assumed principle, that the

[1] *Ossemens Fossiles*, tom. ii. p. 291.

gypsum of Paris is the formation of "*waters of another* "*nature than that of the sea, very probably analogous to* "*our fresh-waters*[1]:" words, as entirely without a meaning, notwithstanding the scientific formality with which they are enounced, as any we can well imagine in conjunction; and to which, it will not be very adventurous to affirm, that the eminent author could not possibly have attached any *distinct* and *real* idea, when he employed them; because, sober science and sense cannot fail to discern, that, "*a water of another nature than that of* "*the sea, not exactly our fresh-water, but a water very* "*probably analogous to our fresh-water,*" is only an elaborated description of a *non-entity*. And yet, a *fact* is required to be admitted and concluded from it, which is to confer the "*glory of disclosing the primitive history of* "*the globe*[2]," in contradiction of all evidence derived from *positive testimony*.

The partial parent of this creative offspring of *invention*, like many other partial parents, was blind to the defects and deformities which glare in the eyes of the indifferent and impartial by-stander. Those alleged *alternations of salt-water and fresh-water inundations*, are as contrary to all philosophical probability, unless we call back into philosophy *occult causes* which Newton banished for ever from it, as they are contradictory of direct and competent testimony; for, such *successions* stand on no ground of *reason* or *experience* whatever, being referrible to no known and adequate *overt cause*. A *salt-water* inundation of the earth, can indeed be traced by the *reason* to the collective *body of the ocean*; but, a *fresh-water* inun-

[1] "*Des eaux d'une autre nature, très-probablement analogue à celle de* "*nos eaux douces.*" *Ossemens Fossiles*, tom. ii. p. 291.

[2] Cuvier, *Disc. Prélim.* p. 2 and 140. — *Theory*, § 1, and end of 34.

dation of the earth, and changes in the *chemical qualities* of the sea, can be traced to nothing ever known to exist out of the *imagination* that engendered and bred them. The *necessity of imagining* these alternating *effects without causes* in order to establish the *hypothesis*, is so far from tending to substantiate the *truth* of the *former*, that it demonstrates the *falsity* of the *latter*[1]. When *we* allege *two revolutions of the globe*, we assign the *causes*, as well as describe the *natures*, of those revolutions: of the first, we allege on authority, the *First Physical Cause* producing immediately that *rent* or *breach* in the primitive continuous spherical surface which enabled the universal superior waters to be collected within *one part only of it*, leaving the *other part dry*. Of the second, we allege the same *First Cause* producing the total destruction of that *dry part* by an *overflow of waters;* and we are supported, by a sound principle of *analogy*, in ascribing that *overflow* to a *repetition of the former operation*[2], producing a *rent* or *breach of* the *dry part* which caused a *refusion* and *transfusion* of the waters upon it, leaving their first basin *dry:* of which *transfusion*, we witness unequivocal vestiges in the earth on every side. But, what were the *causes* of the successive *advances* and *retirements* of salt-waters and fresh-waters, which M. Cuvier calls upon us to "*represent to ourselves?*" for, they are not shewn, neither can they be found, in what is technically termed *nature*. Does he mean (to speak *grammatically*,) that we are to *understand* these words—"and *God said*, let the sea "or the fresh-waters *advance*—let the sea or the fresh-"waters *retire—three several times?*" If he does, let him say so, and shew his authority, and we shall comprehend him. If he does not, then his scheme is undeniably a scheme of *effects without causes:* for, *occult causes* are *no causes* in true philosophy. To confirm the *historical*

[1] See above, note 1 to p. 328. [2] See above, p. 340.

part of his scheme, no aid whatever is borrowed or sought from the authority of *revelation*, his *hypothesis*, can do all without it; or rather, it could do nothing that it wishes to do, if it consented to listen to it. That only competent guide receives a deaf ear, and even the *historical deluge* is not consulted or adverted to; although, by means of its irrefutable testimony, Mr. Professor Buckland has been enabled to give to the *limon d'atterrissement ancien et moderne*[1] of the scheme an intelligible and satisfactory *precision*, which is necessarily wanting in the expositions of the celebrated theorist, *in consequence of his supercilious disregard of that invaluable Monitor.*

But, when we can be certified by competent testimony, that the body of the ocean acted both mechanically and chemically upon the present surface of the earth for sixteen hundred years and upwards, during which long period a vast proportion of its soils, now fixed and indurated, were *soft* and *moveable*; that, during the twelve months of its gradual departure, during which it was "*sweeping over the* "*whole globe*," it was continually propelling over every part of that surface its various *moveable soils*, together with the *animal and other contents of its basin*; that, its propulsions were not uniform but irregular, and *alternating* according to its successive *advances* and *refluxes*: when, after considering all these points by the principles of *true philosophy*, we are to determine—whether we should refer the alternations of soils which we witness in the earth, *generally*, to these several adequate and overt causes, without attempting or affecting to assign the *specific cause* of each particular effect; or, whether we should ascribe them to the *calculated action of a liquid totally*

[1] "*Ancient and modern alluvial mud.*" See above, *9th sub-formation*, p. 381.

occult, and absolutely imaginary: it is very manifest how *true philosophy* will direct every mind to decide, which has any ambition to account itself of the school of Bacon or of Newton: especially, if we add these further considerations; that M. Cuvier's *numerous revolutions of the sea,* after all his invention exercised *against authority* and without consideration of *causes,* do not exceed *three,* whereas we can distinctly ascertain, *by authority* and with knowledge of *causes, two revolutions of the sea* which exclude all admission of a *third;* that, in sound philosophy, "*more causes* of natural things ought not to be "admitted, than are *true* and *sufficient for explaining the* "*phenomena*[1];" and further, that *mineral geologists* also, as De Luc, D'Aubuisson, &c. are obliged to acknowledge the *limitation of their powers of explanation,* by resorting to "*causes which no longer subsist,*" and to "*causes which* "*are unknown to us*[2]."

But, it is not by the test of *revelation alone* that the *fallacy* of this geological scheme is to be detected. "We "might naturally," says M. D'Aubuisson, "divide the "*tertiary soils,* with M. Brogniart, into *two orders,* the "one of which should comprise the formations in which "are found vestiges of *marine animals,* and the other "those which only contain the remnants of beings which "have lived upon *the earth,* or in *fresh-water without a* "*constant admixture of marine bodies;* but that, *this* "*distinction has been too recently introduced, and is not* "*established, at least at present, upon foundations suf-* "*ficiently positive, to authorise us as yet to apply that* "*division*[3].—

[1] 1. *Regula Philosophandi.* NEWTON.

[2] See above, vol. i. p. 110; and ii. p. 151.

[3] *Traité de Géognosie,* tom. ii. p. 402.

" We have considered the soil of the environs of Paris " under its *mineralogical relations*, that is to say, under " the relation of the different *mineral layers* which com- " pose it. If we would now divide it according to the " *fossils* which it contains, we may, with M. Omalius, " distinguish in it *four stages*. The *first*, or *lowest*, will " comprise the *plastic clay*, the *coarse limestone*, and the " *lower sandstone*. The *second*, will embrace the *lower* " *siliceous limestone*, the *gypsum*, and the *lower marls*: the " shells, and the land and fresh-water animals generally, " would here be characteristical, *abstracting the marine* " *shells which are found at the bottom of the gypsum*. " The *third*, would be composed of the *upper marls*, the " *sand*, and *sandstone*: the small number of shells which " are there found, are *sea-shells*. Finally, the *fourth* " would present the great formation of *fresh-water lime-* " *stone*. These stages, remarks M. Omalius, do not cover " each other in all their extent: they are placed, as it " were, retiring from each other, with a slight inclination " towards the south.

" It is with some astonishment, that we here perceive " these *zoological* divisions to be *no longer in harmony* " with the *mineralogical* divisions. The *coarse and sili-* " *ceous limestone*, form but *one mass* nearly continuous, and " yet, we see it divided by the line which separates the " first two *zoological* stages: that which separates the " third and fourth, equally intersects the layer of *marl*. " The difference between the *fossils*, which often indicates " to us the difference between the *mineral formations*, will " no longer be in correspondence with the *geognostic dif-* " *ferences*; the *upper marls*, form an *entire whole* with the " *lower marls*; the difference between their nature and " the epocha of their deposition is *insensible*; and yet, the " difference between their fossils is *extreme*: some are of

" *sea-water*, others of *fresh-water;* these *two classes* are " moreover found *mingled together in the same strata*, as, " for example, in the sandstone of Pierrelaie.

" The soils of Avignon, Mayence, &c. have offered " some new examples of a similar mixture. Besides, " M. Beudant has proved, by a series of skilful and in- " genious experiments, that *in a very short space of time*, " *many fresh-water molluscæ can be habituated to live in* " *water gradually salted till it acquires the saltness of the* " *sea;* and also, that *many sea molluscæ can, by a diminu-* " *tion of saltness equally gradual and progressive, be* " *accustomed to live in fresh-water*[1]; and in fact, *mol-* " *luscæ* of both these classes have been found living pro- " miscuously together in seas moderately salt, as the " Baltic[2]. MM. Beudant and Marcel de Serres have " also discovered shells which are in a manner inter- " mediate, such as the *paludines* which habitually live in " brackish water, and which are sometimes found with " *sea-shells* and sometimes with *fresh-water shells. These* " *new data, introduced into the solution of geological* " *questions, ought necessarily to occasion changes or modi-* " *fications in the consequences to be deduced; and we can-* " *not* NOW *conclude, because a mineral stratum may con-* " *tain some fresh-water shells, that it has been formed in* " *fresh-water, even though the shells should not have been* " *the effect of accidental transport; especially, if it is* " *inclosed between two strata which other circumstances* " *indicate to have been formed in the bosom of the sea*[3].— " With respect to the soils of the *environs of Paris*, where " we see an alternation and even a *mixture of beings of* " *both classes;* this is one of those particular cases *for the*

[1] *Journal de Physique*, tom. lxxxiii. [2] Ibid. tom. lxxxviii.
[3] *Traité de Géognosie*, p. 423.

" *solution of which we have not sufficient data*[1].—Without " engaging ourselves in any *hypothesis* upon the *origin*, " *existence, epocha,* and *disappearance* of the reservoirs of " *fresh-water* which *may have produced* these soils, we " shall conclude with M. Brogniart, (to whom we are " unquestionably indebted for having apprehended this " question in its true point of view[2],)—*that there exist* " *soils, formed before historic times, which, instead of in-* " *closing marine productions, contain, in general, only ter-* " *restrial and fresh-water productions;* and this difference " will in most cases furnish the geologist with an excel- " lent characteristic for distinguishing and characterising " these formations[3]." Thus, he takes the simple fact of the phenomenon, stripped of all hypothetical accretions; but he had first taken the precaution to give the following wise admonitions : " This determination, as I have already " remarked, must be made with *judgment;* and I shall " again call to recollection these considerations: 1. *That* " *remnants of fresh-water or land shells have often been* " *carried down by the rivers into the seas, and must there-* " *fore be found in the deposits formed in their bed.* " 2. *That some species of fresh-water shells sometimes* " *enter into the seas, and live in them near the shores.* " 3. *That it is very difficult to determine whether a fossil* " *shell belonged to the sea or to fresh-water, especially if* " *it pertains to a species which has become extinct*[4]."

Mr. Greenough, had already warily questioned the *capacity of natural history* to pronounce dogmatically of

[1] *Traité de Géognosie,* p. 426.—Cuvier remarks, " vers l'extrémité " du faubourg (St. Denis), lorsqu'on creuse un peu profondément, on " rencontre *ou* la formation *gypseuse, ou* le *gypse* lui-même, *ou* les marnes " *marines* que nous venons d'indiquer, et qui représentent la forma- " tion *marine.*" *Ossemens Fossiles,* tom. ii. p. 386.

[2] Ibid. tom. ii. p. 434. [3] Ibid. p. 435. [4] Ibid. p. 434.

antediluvian shells, whether they pertained to *fresh-water* or to *salt-water*[1]; and, if it has not that capacity, then there is an entire end to the testimony ascribed to the shells found in the *gypsum*. But, neither would M. Cuvier's conclusion be *secure* even if they were *certainly* fresh-water shells, and in *any numbers*; for, as I have ventured to observe in the *Comparative Estimate*—"in the sub-"sidence of the primitive continents, the contents of all "*river-beds* and *lakes* must have been *absorbed by the sea*; "and it is impossible to fix a limit to the transport of "such light and buoyant articles as *shells*, in so turbulent "and active a state of the ocean." The *saline origin* of the *gypsum*, would annul all their testimony.

Such then being, on a close examination, the *geological* part of M. Cuvier's *philosophy*[2], I think that I am perfectly supported and justified in the invidious but indispensably

[1] "Is the distinction between *fresh-water* and *salt-water shells* so "strongly marked that they cannot be confounded? The common test "is the thickness of the shell; but sea-shells are by no means uniformly "thick, as we see in the oyster, &c., nor those of lakes and rivers uni-"formly thin. In a series of *bulla*, *patella*, *pecten*, *pinna*, *argonaut*, &c., "it is easy to find shells so delicate and fragile, as those which are "usually contained in rivers or lakes. I am not aware of any other cha-"racter, by which a naturalist can distinguish *à priori* a fresh-water shell "from one inhabiting the sea." *Geology*, p. 303, 4.

[2] "We are not to be dazzled out of our senses by Blainville, or "Cuvier, or Lacttark (says a strong-minded Critic); we never did and "never will admit, that the *whole science of Geology* is contained in "*M. Cuvier's Preface* (i. e. his "*Theory*"). Our notions of Geo-"logical Science are, we must own, somewhat different from M. Cuvier's; "and we select him for the observation, because there is a dangerous "weight in his name:—dangerous, at least, when in the wrong scale.— "The science of Geology, is neither limited to the basin of Paris, nor to "the study of cockle-shells; it is one which yields neither in difficulty or "dignity, to any department of Natural History." *Edinb. Review*, vol. xxxvii. p. 59.

necessary service, of refusing to concede *unconditionally* to his eminence the *same* applause for his "*reasoning on the* "*early state of our planet*," as for his "*history of its fossil* "*inhabitants*[1];" and of resisting his high and inadmissible pretension—"*of having so rigorously established the facts of* "*the ancient history of the globe, as to have made them be* "*considered points so determinately fixed as to admit of no* "*departure from them*[2]." And I shall, therefore, not scruple to repeat the observation which I have already expressed respecting that great and illustrious comparative anatomist: that, "it is not by endeavouring to deduce "*geological theories* from the fossil remains to which he "has devoted so much ability and zeal, that he will "serve the cause of *true knowledge*; it is, by applying his "anatomical skill and experience to discriminate between "the *extinct* and the *preserved* species, and thus *to bring* "*us acquainted with those animal races which the Author* "*of Creation thought fit to exclude from His renovated* "*earth*[3]." In this sublime pursuit, he is, and probably will remain for ever, unrivalled; and, standing upon so exalted and conspicuous a summit in this rich and extensive *province of science*, which he has, in a manner, *conquered for himself*, he need not consider his rightful dignity assailed, if his pretension to an equal authority in the province of *geology* is *conditionally* disputed; since his superior endowments are able to remove the *objected condition*, whenever he shall submit them to that Paramount Authority which alone can render his authority in geology *legitimate*.

[1] See above, p. 356, *note*.

[2] *Theory*, § 2.

[3] See above, p. 143.

Note [V.]

On the Recent Discovery of Fossil Human Remains, at Durfort and Kösritz.

The great question, concerning *Human remains in a fossil state,* stands now before the world under a new aspect; entirely different from that under which it stood at the period when M. Cuvier first published his celebrated *Theory of the Earth,* and even, at the period when the Chapter of the *Comparative Estimate* to which this Note has reference was first written. This new aspect, is to be dated from about the year 1820; when the *Cavern of Durfort,* and the *Quarries of Kösritz,* were first laid open for the instruction of Science. The important phenomena disclosed in those two repositories, have burst upon us so recently and so suddenly, that they have not as yet been duly estimated or contemplated; and consequently, the conclusions which they are constituted to yield, have not been adequately drawn out. Yet, a comparison of their respective phenomena, and a collation of these with the phenomena of the *Cave of Kirkdale,* must henceforth form the *basis* of that question; and, the light which these unite to impart, will illustrate all other cases which have hitherto been abandoned to the latitude of invention and hypothesis, from the total want of any adequate rule for determining their indications.

The *Cavern of Durfort,* is wholly unnoticed in the chapter of the "*Reliquiæ Diluvianæ*" specially entitled "*Human Remains in Caves;*" it is equally unnoticed by the Quarterly and Edinburgh Reviewers of that work; and, although the *Quarries of Kösritz* are therein ad-

verted to, yet it is in too summary a manner for the reader to form a correct judgment of their importance for determining the great question. I shall, therefore, enter into some particulars of these two repositories; commencing with those of the *Cavern of Durfort*.

When M. D'Hombres Firmas visited the mines of Durfort for the first time, in 1795, he was informed by the country people of a neighbouring cave, called in the dialect of the district, *La Baumo das Morts;* which, they said, contained *petrified men*. Excited by the accounts which these people gave him of the cave, he penetrated with much difficulty into its inmost recesses. Twenty-five years after, namely, in 1820, he visited the cave for the second time; and in the following year, 1821, he drew up a short article upon its subject, which was printed in the *Bibliothèque Universelle* for the month of May in that year, under the title, "*Notices sur des ossemens humains fossiles.*" This paper was followed in 1823 by a much longer and more elaborated communication from M. Marcel de Serres (who had visited the cavern in 1818, in company with other naturalists), which article was inserted in the same Journal under the months of August and September of that year; entitled, "*Observations sur des ossemens humains découverts dans les crevasses des terrains secondaires, et en particulier sur ceux que l'on observe dans la Caverne de Durfort dans le Département du Gard.*" The following, is an abridged and combined account of the *phenomena* of this Cavern, as those two scientific observers have severally imparted them to the world.

"The *Cavern* is situated about a mile S.S.W. of "Alais, and about the same distance N.W. of the small "village of Durfort, near the summit of the western "declivity of the mountain of La Coste; and about 300 "feet above the level of the Mediterranean. The moun- "tain consists of two different *calcareous formations*, as

" distinct in their positions as in their mineralogical " natures. The inferior formation, consists of *transition* " *limestone* and of a *blackish sandstone;* in the mass of " which no organised bodies are discernible, although the " surrounding rocks exhibit an astonishing quantity of " petrified shells, siliceous and calcareous[1]. The upper " formation, appears to belong to the *Jura* or *cavernous* " *limestone (calcaire jurissique* ou *caverneux — rauch-* " *wacke* des Allemands). This limestone exhibits, through- " out the chain, a great number of subterraneous cavities " of vast extent. It is compact, fine-grained, slightly " conchoidal in its fracture. The *orifice* of the cavern, " presents itself in a *vertical fissure* or *crevice* in the sur- " face of the ground, about five feet in length, and one " foot and half in width. The descent is *perpendicular* " for about 20 feet, and must be made by pressing with " the back and knees against the rugged sides, in the " manner of chimney-sweepers. At the bottom of this " *tunnel (tuyeau)* is the entrance to the *Cavern of the* " *dead,* which is so small as to afford *an opening of only* " *about one* (French) *foot square;* it is but a step, but it " is difficult to pass. From thence you enter into a " sort of *gallery* or *passage* (the extent of which is " not given), which, from its narrowness, might be " called *un caveau,* and which, as it extends, divides " itself to the right and left. The passage to the right, " leads by a gentle slope to the principal chamber, the " dimensions of which are only from ten to twelve feet in " length, and three feet in height and width. The " greatest height of the cave is at the entrance, where it " does not exceed five feet and half; so that, as the rest " of the cave is still lower, a middle-sized man can hardly " stand on his feet in it. The passage that leads to the

[1] " Une quantité étonnante de coquilles pétrifiées silicieuses, cal- " caires, pyriteuses, de diverses grandeurs."

" principal chamber, is remarkable for its sides and roof;
" which appear to consist of one single mass of limestone,
" the surface of which is as even as that of the argilla-
" ceous schists which accompany coal. The passage to
" the left, extends to an equal distance with that to the
" right, but is pursued with still greater difficulty, being
" considerably lower. No bones are seen, either in this
" passage, or in that to the right. The limestone in this
" place, appears to be of a lighter blue than that which
" forms the principal chamber; the exterior surface is
" covered with a thick coating of calcareous *stalactites*
" and *stalagmites* of a dirty yellowish brown; its mass is
" also traversed by numerous spathitic veins. The cave
" is terminated by the small chamber, three feet in the
" square, in which all the human bones are found; which
" lie *pêle-mêle* in the paste that unites them, and in
" quantities so great as to form more than half of the
" bed. The bones, are partly filled with an extremely
" fine calcareous earth coloured by oxide of iron. The
" floor, is raised more than half a foot above the true
" floor, which is covered with human bones, some of
" which are insulated from the rest; a great number are
" united to the rock, to which they have been fixed by
" the calcareous incrustations. In all parts of the princi-
" pal chamber human bones are found, chiefly those of
" *the head*, and the *long bones*. These lie without any re-
" lation to the skeleton, and it would be impossible to
" find a sufficiency to compose an entire skeleton. As
" the floor appeared to sound very remarkably, we ima-
" gined it might be hollow; we therefore caused it to be
" penetrated at the point which produced the greatest
" sound; but we soon discovered, that these resounding
" parts were only thick portions of the calcareous tufa
" which had enveloped the bones, and which has ceased
" to increase. The bones have not been rolled; they are

" not mineralised, but retain a portion of their *gelatine,* " *like those in the Cave in Yorkshire described by* " *M. Buckland in the Philosophical Transactions for* " *March* 1822[1].

" Such are the principal particulars of the *Cavern, of* " *Durfort;* where are dispersed numerous human bones " *both of young subjects and of adults,* (and unquestion- " ably the latter are most abundant,) and also of some " which may have pertained to *women.* With these " human bones, no remains are discovered that pertained " to any animal, excepting a single shell, the *helix* " *striata.*—As to the Cave itself, it possesses nothing " remarkable, if it were not for the *multitude of human* " *bones calculated to astonish by the succession of difficulties* " *encountered in visiting them.*"

No minute chemical account is given of the mineral matter accompanying the bones: M. D'Hombres Firmas only says, that it consists — " *d'une couche de terre fine,* " *friable;*" and that — " *le limon ne s'incorpore pas avec* " *les incrustations, et ne sauroit se durcir comme elles,*" (p. 37, 38.); and M. De Serres only says, — " *les os de* " *Durfort ne sont enveloppés que par des tufs calcaires,* " *ou par des terres meubles,*" (p. 30.) It is evident from his report, that the inferior or true floor beneath the bones has not been closely examined; we are therefore entirely ignorant, whether any portion of the calcareous fluid had insinuated itself beneath the bones, so as to form an *inferior stratum of stalagmite.*

These enterprising naturalists, proceed next to assign a *cause* for the presence of these bones in the heart of this *calcareous rock.* After stating all the hypotheses which suggested themselves to their imaginations, they reject

[1] See above, p. 287, *note.* M. Firmas considers these bones to be *fossil,* a denomination which M. de Serres disapproves.

them all. " It would have been *too difficult* (says " M. D'Hombre Firmas,) *to introduce carcasses by the " orifice we have described*[1]; and we have in vain (i. e. " in two examinations at the distance of 25 years,) " endeavoured to find the trace of any other entrance, " either in the cavern or at the outside." " The *dif-" ficulty of the entrance* (says M. de Serres,) *would have " opposed an invincible obstacle to the introduction of " carcasses*[2]." This was the great difficulty also at Kirkdale—viz. *how the bodies were got in?* What, then, after those declarations, are the conclusions of these two naturalists respecting the cause of the phenomenon? They coincide nevertheless in this conclusion — that the bones must have been introduced *by the hand of man;* but, " *piecemeal,*" or in their present divided state, as by the hyænas at Kirkdale: the *disproportion of the orifice to the bulks within,* creating a similar embarrassment in both cases. And, what are the *determining reasons* that compel each to draw a conclusion so contradictory of his premises? M. Firmas argues, " that in the total silence " of history on the subject, he is bound to adopt the " traditional belief of the country people, that the bones " were, at some remote and unknown time, brought " and deposited in the cavern — *la tradition, qu'on doit " suivre lorsque l'histoire se tait.*") M. de Serres, is partly influenced by the opinions of " *MM. les Docteurs " Salandre et Teissier*" — that " there *must exist* some " larger entrance for penetrating into the cavern; an

[1] " Il eût été *trop difficile* d'y introduire des cadavres *par l'ouverture* " que nous avons décrite; nous avons vainement cherché les traces d'une " autre issue, dans la caverne et à l'extérieur." (p. 39.)

[2] " On ne peut pas les considérer comme les restes des cadavres que " l'on y auroit ensevelis, même quand la *difficulté de l'entrée* n'y mettoit " pas un *obstacle invincible.*" (p. 28, 29.)

" entrance, which *no one has been able to discover*[1];" and partly by a report, that one *Mathieu*, a master-miner, who first discovered the cavern about *sixty years* ago, found the present orifice *closed up with materials which he demolished*[2]: in which traditional *materials, closing*, and *demolishment*, M. de Serres' rapid imagination sees at once a *regular masonry* sealing a sepulchral receptacle, within which multitudinous bones, " *collected* " *from some ancient field of battle*," had been piously deposited. But, M. Firmas will enable us to ascertain the *materials* which must have closed the orifice, at the time when Mathieu explored it for the *first time*: " the " shepherds and passengers (he says) who do not dare to " venture down into it, *throw in stones* which roll down, " accumulate, and will in the end *entirely close it up*[3]; " we were obliged to remove some of these stones, in " order to thrust ourselves into the hole." Here, we detect the real nature of the *obstructing materials* which Mathieu must have had to remove, in making his first entrance into the cavern; but, of which no evidence now remains, either in *sample* or in *description*.

But, mere *ingenuity* and *inventive speculation* cannot establish any thing sound and rational in solution of the

[1] " MM. les Drs. Salandre et Teissier — pensent encore qu'il *devoit* " *exister* une ouverture plus considérable pour pénétrer dans cette " caverne, ouverture que l'on n'a pas encore su découvrir." (p. 34.) Compare this judgment with note i. p. 345.

[2] " Lorsque le maître mineur Mathieu découvrit, *il y a une soixantaine* " *d'années*, cette grotte, il s'aperçût qu'il existoit une ouverture naturelle " dans le rocher, laquelle avoit été *bâtie*: — il démolit les *matériaux* à " l'aide desquels *on l'avoit fermé*." (p. 30, 34.)

[3] " Les bergers et les passans qui n'osent pas y pénétrer, y *jettent* " *des pierres* qui roulent, s'amoncelent, et finiront par *boucher tout-à-fait* " *ce passage*," &c. (p. 34.)

problem before us. We have now *philosophical ground* firmly laid, on which alone we can attain to such a solution. That *ground* is laid, in the manifest *analogy* disclosed between the kindred phenomena of *Durfort* and of *Kirkdale;* and the unequivocal *parallelism* of those phenomena, enables us to satisfy our reason, at the same time, respecting *each: each* will reflect its light upon *the other,* and *both* will look back to *one and the same common cause.* It will be plain to every one who compares the descriptions of the two caves, that the leading circumstances, geologically considered, are so peculiarly analogous, that if we read in the Durfort account "*young* "*and full-grown elephants,*" &c. instead of "*young and* "*adult human subjects,*" we shall almost seem to be reading the Kirkdale report[1]. The promiscuous congeries, of fractured and unrolled bones — of individuals of different ages — unmineralised — imbedded in stalagmite — in the interior of a cavernous *limestone rock* — within a fissure whose orifice is disproportionate to the living bulks of the bodies to which the bones belonged — being phenomena common to both caves, declare the cause to be *common* and *identical.* This close analogy, affords the only secure clue to a solution of the compound problem in which the double phenomena can never now be separated; and it therefore renders the *Supplement* relative to the *Cave of Kirkdale,* equally relative to the *Cave of Durfort.*

The *Quarries of Kösritz,* explored about the same time as the Cave of Durfort, constitute a remarkable *link* connecting the two former bodies of phenomena. The *Kirkdale Cave,* contained only remains of *brute species, extinct and actual;* the *Durfort Cave,* contained only remains of the *human species;* the *Quarries of Kösritz,* on the contrary,

[1] See above, the general description of the Kirkdale cave; p. 287.

contain the remains *both of the human and brute species,* under the same geological circumstances. We shall now, therefore, proceed to consider those *Quarries;* for the important knowledge of which, we are entirely indebted to the researches of the Baron von Schlottheim.

The limestone formations which flank the valley of the Elster in the neighbourhood of Kösritz, in Upper Saxony, consist of *zechstein* or *alpine limestone,* which passes into *cavernous limestone.* This latter limestone, is accompanied with subordinate beds of ancient secondary *gypsum,* so compact as to require to be blasted with gunpowder. The gypseous mass is perforated with fissures, not so broad as in the superincumbent limestone, but filled with the same loamy deposit. In the fissures or cavities of the limestone, have been found remains of the antediluvian rhinoceros, of enormous oxen and stags, of an antediluvian hyæna, and of the *leo diluvianus* resembling the jaguar. These bones are nearly in the state of those at Gailenreuth, Scharzfeld, &c.—In the fissures or cavities of the subordinate gypsum formation, *human bones* distinctly recognisable have been found, together with bones of small quadrupeds and of birds, at the depth of 16 to 30 feet, in every quarry which has been opened; not in caverns, but enveloped in the loam. To investigate more accurately these extraordinary monuments, M. von Schlottheim repaired to Kösritz, in the spring of 1820, accompanied by M. Braun; and he published at Gotha, in the same year, the result of his researches, in the Introduction to his work entitled *Petrefactenkunde*[1]. That *Introduction* was immediately translated into French by an eminent mineralogist,

[1] M. D'Aubuisson (tom. ii. p. 473) cites M. v. S.'s testimony to this phenomenon, from Leonhard's *Taschenbuch für die gesammte mineralogie,* of 1816. " Mais ce qui est le *plus remarquable,* ce sont des crânes

M. Jean Charpentier, Director of the mines at Bex, and was printed in the *Bibliothèque Universelle* for the month of November of the same year. It was also translated into English by Mr. Weaver, and published in the *Annals of Philosophy* for Jan. 1823. M. von Schlottheim published a *Supplement* to his former work, in 1822; of which, a translated *Extract* is added by Mr. Weaver to his other translation. To these last translations, Mr. Professor Buckland refers in p. 167—169 of his *Reliquiæ Diluvianæ;* and he thus concludes, respecting the phenomena at Kösritz: "*The chief point is* CONCEDED (*by M. v. Schlottheim*), viz. *that the human bones* (at Kösritz) *are* NOT "*of the same antiquity with those of the antediluvian* "*animals that occur in the same caves with them*[1]." It is my intention to examine this alleged *concession*.

"From the facts now detailed in the present, and in "my former communication, it is quite evident (says "M. v. Schlottheim in his *Supplement*), that in the country "near Kösritz *human bones* are found intermingled, without order, with the bones of animals of the *ancient* "*world* and with those of *existing species;* and, under *pre-*"*cisely the same circumstances*, being firmly enveloped "and compacted in the loamy deposit which occupies "the fissures and cavities of the bed of gypsum that "occurs in that vicinity.—All these considerations give, "on the first view, probability to the conclusion, *that the* "*other animals were destroyed at the same time with man;*

"*humains*, que M. de Schlottheim assure en avoir été retirés (*i. e.* des "tufs de l'Allemagne), et qui y étaient bien réellement enveloppés par "le tuf." Mr. Pr. Buckland did not view the importance of the phenomenon in the same light, for he only represents the Kösritz rocks as containing "the bones of hyænæ mixed with those of rhinoceros, horse, "ox, stag, bear, and extinct tiger," (*Reliq. Diluv.* p. 25); omitting in the catalogue the *human bones*.

[1] *Reliquiæ Diluvianæ*, p. 169.

" —an opinion which I have already advanced[1]." That opinion was advanced in the following terms, in the *Introduction* to his first work. " It is evident, that the " human bones could neither have been *buried here*, nor " have *fallen into the fissures of the gypsum during battles* " *in ancient times*, nor have been thus mutilated and " lodged by any other accidental cause in more modern " days; inasmuch as they are *always* found with the " other animal remains under the same relations, not con- " stituting connected skeletons, but collected in various " small groups in the deposit of loam that occupies the " fissures and cavities of the gypsum. They appear, " therefore, to be strictly *fossil*, and to have been swept " hither by floods with the other animal bones, at the " period of the formation of the alluvial (diluvial) tract " itself. If, as may be expected, these phenomena should " be further confirmed by the more extended examination " of the Kösritz district, now in progress, it will render " probable the supposition, that *the human bones found* " *in calcareous tufa also, are likewise referrible to* " *the* SAME PERIOD[2]." M. J. Charpentier's translation is to this effect; " We are therefore to presume, that these " human bones are *really fossil*, and contemporaneous " with the other bones along with which they are found; " and, that they have been brought and deposited by the " waters which formed the accumulations and alluvions " that cover the secondary rocks of that country.—If this " conjecture be confirmed, &c. it will be beyond a doubt, " that *the remains of the human species found in the calcareous* " *tufa, date from the* SAME ANTEDILUVIAN EPOCHA— " *datent de la même époque antédiluvienne*[3].—The tradition " of a *deluge* preserved among all nations, now appears

[1] *Ann. of Philos.* 1823, p. 29. [2] Ib. p. 32.

[3] *Biblioth. Univ.* tom. xxv. Nov. 1820, p. 184. I have not been able to compare these two translations with the original.

" further confirmed by the *instructive documents lying* " *before us.*"

In his *Supplement*, however, M. v. Schlottheim was led to raise *a doubt* of the accuracy of his first conclusion, from the single circumstance, that remains of *existing*, as well as of *extinct* animal species, were found with the *human bones*: " Several important *doubts*, however, arise (says the " Baron):—as far as is *hitherto known*, remains of *recent* " species have *not been found in any other place* inter- " mingled with those of the *more ancient*." Upon this ground *alone*, he *suspended* (not *renounced*) his first conclusion. But, this ground of *doubt* Mr. Weaver triumphantly removes, by citing *the contents of the Cave of Kirkdale* explored by Mr. Professor Buckland in December 1821, (though not known to the world till after M. v. Schlottheim's *Supplement* had been printed); comprising remains of *extinct and existing* species intermingled[1], which the scientific Professor has pronounced and shewn to be contemporaneous, and *all equally antediluvian*. Under his *actual inscience of that important and determining fact*, however, M. v. Schlottheim reasonably thought himself obliged to *suspend and qualify his first conclusion*; and to assume, " that the human bones must " belong to a much later period than that of the large " land animals of the ancient world:"—yet adding, " thus much, however, appears to be proved, that they " occur here in a *really fossil state*, having been brought " hither by floods *at very remote periods*[2]."

But, M. v. Schlottheim's first deliberate conclusion from the phenomena was thus only *checked* by the occur-

[1] " In this position (says Mr. Weaver), the Kirkdale cave in York- " shire, in which *extinct* and *existing* species occur together, appears to " afford a *direct answer*." *Annals of Philos.* 1823, p. 29, *note.*

[2] Ibid. p. 31.

rence of a cautious *doubt*, arising from an *uncertainty* whether recent species *could* have been contemporaneous with ancient or extinct species? If it was shewn to be *possible*, much more if *actual evidence of the fact* could be produced, then *his first conclusion would necessarily remain fixed and secure*.

That it was *possible*, and not only *possible* but *real*, is lucidly exposed in Mr. Weaver's admirable comment on M. v. Schlottheim's *doubt*. "It is to be observed, that in "the fissures and cavities of both formations (at Kösritz); "the remains met with belong partly to *extinct animals*, "and partly to such as agree with *existing species*. In con- "sidering the animal remains discovered in caves and in "diluvian tracts, it appears hitherto to have been the "practice to confine the terms '*animals of the former*, '*ancient*, or *antediluvian world*,' to such as are *extinct*. "But, if the deluge was the great agent by which land "animals were destroyed, and if, in the existing order of "beings, the races were renewed *with certain exceptions*, "we might expect to find in the depositions consequent "to that catastrophe, the remains *both of extinct animals* "and of such as correspond with *recent species*. And, we "*do so find them*, e. g. in the cave, or rather series of "caves, discovered at Oreston near Plymouth; and, that "these are referrible to *antediluvian races*, appears to be "*proved* by the unequivocal circumstances attending ana- "logous remains in the KIRKDALE CAVE, in Yorkshire[1]."

[1] Page 33, 34, *concluding note*. — Since this *Note* was written, the following confirmative communication from Mr. Professor Buckland to the Editor of the *Courier*, appeared in that Paper of December 16, 1824.

"An immense assemblage of Fossil Bones has recently been disco- "vered in Somersetshire, in a cavern of the *Limestone Rock*, at Banwell, "near the west extremity of the Mendip Hills, on the property of the "Bishop of Bath and Wells. The circumstances which led to this dis- "covery are as follow:—Some miners engaged in sinking a shaft in search

Now, I must take leave respectfully to observe, that, since Mr. Professor Buckland has himself shewn the *reality of the fact*, a *doubt* respecting which fact *alone* drew Baron v. Schlottheim back from his first conclu-

" of calamine, intersected a steep and narrow fissure, which, after de-
" scending 80 *feet*, opened into a spacious cavern 150 feet long, and
" about 30 feet wide, and from 20 to 30 feet high. From the difficulty of
" descending by this fissure, it was lately judged desirable to make an
" opening in the side of the hill, a little below, in a line which might
" lead directly to the interior of the cave. This gallery had been con-
" ducted but a few feet, when the workmen suddenly penetrated *another*
" *cavern* of inferior dimensions to that which they were in search of,
" and found its floor to be covered, to a depth which has not yet been
" ascertained, with a bed of sand, mud, and fragments of limestone,
" through which were dispersed an enormous quantity of bones, horns, and
" teeth. The thickness of this mass has been ascertained, by a shaft
" sunk into it, to be in one place nearly 40 feet. Many large basket-
" ful of bones have already been extracted, belonging chiefly to *the* ox
" *and* DEER *tribes, of the latter there are several varieties, including the*
" ELK; there are also a few portions of the skeleton of *a* WOLF, *and of a*
" GIGANTIC BEAR. The bones, are mostly in a state of preservation equal to
" that of common grave bones; but, *it is* CLEAR *from the fact of some of*
" *them belonging to the great extinct species of bear, that they are of*
" ANTEDILUVIAN ORIGIN.

" In the roof of the cave there is a large *chimney-like opening* which
" *appears to have communicated* formerly with the surface, but which is
" choked up with fragments of limestone, interspersed with mud and
" sand, and adhering together imperfectly by a stalagmitic incrustation;
" through this aperture *it is probable the animals fell into the cave and*
" *perished*. The immense quantity of the bones shews the number of indi-
" viduals that *were lost in this natural pit-fall* to have been very great.
" In this manner cattle are now continually lost by falling into *similar*
" *apertures in the limestone hills* of Derbyshire.

" There is nothing to induce a belief that it was a *den inhabited by*
" *hyænas* like the Cave of Kirkdale, or by *bears* like those in Germany;
" its leading circumstances are similar to those of the ossiferous cavities
" in the *Limestone Rock* at Oreston, near Plymouth." The whole of this statement is amenable to the arguments and conclusions contained in the preceding Supplement, *On Caves in Limestone-Formations.*

sion, " *that the human bones were of the same antiquity* " *with those of the extinct animal species mingled with* " *them;*" the eminent Professor cannot, with any consistency, allege, much less can he take ground on the allegation, that the Baron " *concedes*" the contrary; because, *his own discovery* entirely takes away the *only* ground of the Baron's *cautionary and conditional doubt,* and becomes therefore, in effect and truth, *a direct* WITNESS *and* VOUCHER *of the soundness and correctness of his* FIRST CONCLUSION.

It appears, then, 1. That the *Cave of Kirkdale* contains the remains of antediluvian *brute species,* some of which are *extinct* but others are *still existing:* 2. That the *Cavern of Durfort* contains remains of the *human species,* under geological circumstances exactly similar to those of the antediluvian brute species at Kirkdale: and, 3. That the *Quarries of Kösritz* contain mingled remains of *all of these,* both *brute* and *human,* under identically the same geological circumstances; *i. e.* enclosed in a *dessicated calcareous paste* indurated into LIMESTONE ROCK. The last of these three, as has been observed, constitutes an *intermediate link,* uniting the phenomena of the former two with its own phenomena in one compound and indissoluble body of *geological evidence.* We cannot, therefore, reasonably doubt, that the *phenomena* at Durfort and at Kirkdale are to be referred to the same common *cause* and common *epocha;* because, we find them *identified,* in relation both to *cause* and *epocha,* by the phenomenon of their certain *union* in the monuments at Kösritz. " A " *single fragment of a human bone,* obtained unequivocally, " and under the *same circumstances* with those of any " *extinct species* of other animals, would be *conclusive* upon " this point," says ingenuously the Edinburgh Reviewer of the *Reliquiæ Diluvianæ*[1]. I appeal to the acuteness of

[1] No. lxxvii. p. 224.

this writer's judgment and to the sincerity of his intellect, whether that *conclusive evidence* is not here at last placed before him? The particular local diversities of *union* or *disunion* of the several fossil subjects, must have entirely depended upon accidental and local causes, operating in the uncertain action of the inundation. It will follow, therefore, that *human bones*, wheresoever found under circumstances similar to those which we have contemplated at Durfort, must be referred to the same cause and the same epocha, if no *overruling reason* occurs to oppose the reference: which overruling reason, cannot possibly exist in *gratuitous hypothesis* or in the mere "*play of invention*," but can only arise from *direct* or *collateral evidence*.

With this sound principle to guide and govern us, I shall close this Note with a brief consideration of the *six* cases of "*human bones in caves*" adduced in the *Reliquiæ Diluvianæ*; of which, those at Kösritz form the *seventh*.

1. The first case (p. 164)—"of human bones incrusted "with stalactite in a cave of *mountain limestone* at Burring- "don, in the Mendip Hills, (says Mr. Professor Buckland, "p. 164,) *is explained* by the cave having *either* been "used as a place of sepulture in ancient times, *or*, been "resorted to for refuge by wretches that perished in it, "when the country was suffering under one of the nume- "rous military operations which, in different periods of "our early history, have been conducted in that quarter." I must here beg leave to observe, that nothing "*is ex-* "*plained*" by proposing *two* different and contradictory conjectures, neither of which is in the slightest degree supported by any *accompanying and determining evidence*; especially, as a *third* explanation might be added, supported by the *determining analogies* of the cases we have just disposed of. Yet, upon the sole ground of those *two* optional and opposite conjectures, Mr. Buckland proceeds

to affirm, " that though the state of the bones at Burring-
" don affords indications of *very high antiquity*, there is
" *no reason* for not considering them as *postdiluvian*."
There is, assuredly, the same reason for not considering them as *postdiluvian*, after contemplating the geological description given of them, as that which we have found for not considering those at Durfort and Kösritz as *postdiluvian*. With respect to " wretches perishing in a
" cave, *because* military operations were conducted in
" their quarter," I confess, I do not trace the certain philosophical correspondence required, of *cause* and *effect*; I must acknowledge, that the suggestion appears to me to stand stronger on *convenient invention*, than on *historical experience*. And, with respect to the allegation of
" an ancient catacomb and barrow at Weller in the same
" neighbourhood," in corroboration that the limestone cave at Burringdon was " a place of sepulture in early
" times;" it cannot surely have more weight in the argument, than the allegation of a churchyard in the neighbourhood of Durfort.

2. The second case (p. 165)—" of the remains of human
" bodies in the most secluded and distant part of a large
" fissure of the Wokely Hole, also in the *calcareous* Men-
" dip Hills, and separated from the main chambers of the
" cave by a subterraneous river of considerable size"—is open to the same remarks. We have here a position described, analogous to the secluded recess in the cavern of Durfort. Mr. Buckland says; " Among the loose bones I
" found a *small piece* of a coarse *sepulchral urn*." Why, I would beg leave to ask, a *sepulchral* urn? It can only be legitimately stated, in the first instance, to be " a small piece
" of *coarse pottery*;" whether it be part of a *sepulchral urn*, becomes another question. But, if these bones had been placed in sepulchral urns, *many pieces* would probably have been found among " the teeth and human fragments,

" dispersed through reddish mud and clay, and some of " them united with it by stalagmite into a firm osseous " breccia." Whereas, since the bones are stated to " have " been broken by *repeated digging*," the fragment in question may just as probably be a remnant of *some earthen vessel pertaining to the labourers employed in that digging*. The entrance of the *high-floods* into this cave, cannot prove the bones to be *postdiluvian:* since it is acknowledged, that they have *resisted those floods, and* " *are very* " *old*," no inference can be deduced from that circumstance to *limit their high antiquity*, or to authorise a decision that they are " *not antediluvian*."

3, 4, and 6. These cases, must also be subjected to the rule resulting from the combined phenomena, of Kirkdale, Durfort, and Kösritz.

5. The fifth case, of a single female skeleton manifestly modern, found in the open cave of Paviland, has no common point of analogy with the other five cases.

Thus, then, it is now at length fully apparent; that, although the great mass of the *human population* of the antediluvian earth must have perished under circumstances which have prevented so multitudinous a dispersion of their remains as of those of the *brute creation*, yet, some scattered *vestiges* of that population have at last been recovered, to evidence their *participation in the same Universal Catastrophe*.

Note [VI.]

On the Eastern Origination of Mankind[1].

It is alleged by Voltaire, in the Introduction to his discourse on the *Spirit of Nations*, that "whoever considers "nations as a *philosopher* will begin his contemplation *in* "*the East*, from whence population, &c. first proceeded;" and he immediately applies his principle, by placing *the Chinese* first in the order of his History, as the *most Eastern* people of Asia. He needed not to be told, that the idea of the East is an idea entirely relative, and, that a point considerably to the East of all Europe, may nevertheless be West of the greater part of Asia; but, we are aware of the motive which prompted him, and the school over which he presided, to disregard that distinction and to advance the *Chinese* to the foremost rank upon the page of history; and we are, at the same time, equally aware of the effrontery of affecting a grave appeal to the dark and incompetent traditions of the Chinese, which appeal is made with no other view than to endeavour to exalt their spurious authority, in the impious but vain hope of depressing, in an equal proportion, the Sacred testimony of Scripture.

Nevertheless, the argument that endeavours to carry the origin of civilisation and of science *indefinitely Eastward*, and which strives to attach to the name of *the East* such mysterious importance, has chanced to derive a sort of indirect support from an *error* first introduced into the

[1] This Note, is a corrected reprint of some observations published several years ago in *The Oriental Collections* of Sir William Ouseley, with a few additions.

text of Genesis by the ancient Greek interpreters of the Pentateuch; which error, passing by their authority into almost every subsequent *version*, has been adopted by the generality of learned investigators of antiquity. It is the rectification of that *inveterate error*, that forms the subject of this Note. In Gen. viii. 3, the sacred historian relates, that when the waters of the Deluge had begun to retire from the surface of the earth, the ark of Noah, which contained the first parents of a new race, came to a station *on the mountain of Ararat in Armenia;* where, the family of the great Patriarch first descended from that fabric; where, they resumed the occupations of a stationary life; and from whence, the *first population of the earth was to issue forth.*

The first account of the *movements* of that new race, is contained in Gen. xi. 2. But, here the Septuagint introduce a clause, which is abhorrent from the sense, and perversive of the terms, of the original record. They make the historian relate thus: *και εγενετο εν τω κινησαι αυτους* ΑΠΟ ΑΝΑΤΟΛΩΝ, *ευρον πεδιον εν γη Σεναας*—"*And it came to pass* "*as they moved* FROM THE EAST, *they met with a plain* "*in the land of Senaar,*" or *Babylonia.* Here, we encounter a statement which introduces extreme disorder into a short, direct, and simple narrative. The historian had deposited the patriarchal family in the neighbourhood of Ararat in Armenia; the first place to which he conducts their offspring, is the plain of Senaar, lying South East of Ararat; yet, he is made by the Greek translators to bring them thither, *απο ανατολων*, "*from the East.*" This interpretation, has been productive of much theoretical evil; and has obliged many persons to be silent, without conviction, when the authority of Moses has been confidently urged in evidence of mankind having spread to the *East of Asia*, and having grown up there into civilisation and political importance, before they made a *retrograde* or *Western movement* towards their primitive seats in the neighbour-

hood of Tigris and Euphrates; on which latter river, they *then* raised the celebrated Tower of Babel or Babylon. For, certainly, if the translation of the Septuagint be legitimate, either the historian contradicts himself, or he leaves a most unaccountable and embarrassing *chasm* in his history; namely, between the first establishment of mankind *in the West of Asia*, and their supposed *return from the East of Asia* to the land of Senaar: of which interval of time, he does not intimate a single event or circumstance.

But, the whole of this difficulty will be found to have proceeded from an injudicious choice originally made by the Greek interpreters, between *two senses of an equivocal word.* The term קדם in the original, expresses both—*in principio, olim,* (*at first, originally,*) and—*ex Oriente,* (*from the East*[1],) between which two senses, the Alexandrian translators unfortunately made choice of the latter for this

[1] קדם, "*antiquum, priscum; ante, pridem, olim, antrorsum; Oriens.*" (CASTELL. *Lex. Heb.*)—The primary sense of this word, is *ante—before,* generally, with relation equally to *time* and *place.* In its relation to the *former,* it obtains the signification of *antiquum—ancient,* or *before other things*: as "*ante,* mare et tellus, &c." (Ovid. *Met.* lib. i.): in its relation to the *latter,* it acquires that of *antrorsum—before* or *in front of the person,* and from thence, it derives its secondary sense of *the East,* or that part of the world which was considered as *before* or *in front,* by excellence. No custom seems to have been more extensively prevalent among primitive nations than this, of regarding *the East* as *the front,* and denominating the cardinal points of the heaven with reference to it. Hence, the Hebrews called the South the *right-hand,* the North the *left-hand,* and the West the *after* or *behind*:—"à situ Orientis quæ *anterior* "*pars* vocatur, meridionalem appellant *dexteram,* septentrionalem *sinis-* "*tram,* et occidentalem *posteriorem*" (CASTELL. ימין): "nempe quod "Hebræi in geographia faciem ad Orientem verterent." (MICHAELIS. *Sup. ad Lex. Heb.* no. 993.

"By this notion (observes Michaelis) we are to explain Psalm cxxi. 5. 'Jehovah is thy shade *upon thy right hand,*' i. e. *on the South,* 'so that 'the sun shall not smite thee by day.'" Vestiges of this custom are

place; and inserted it in their text, where it has become the vicious authority for the same interpretation in the succeeding versions. Great has been the confusion, resulting from this ancient misconstruction of the original; nor, have the means employed for remedying the evil been such as to conduce to success. Some, admitting the interpretation of the Greek, have strove to *elicit* a consistent meaning for the historian. Among the number of these is Bishop Patrick, who, rendering the original, with the Greek and our English version, "*from the East*," thus gratuitously and imaginatively remarks: "He doth not speak of "*all* the posterity of Noah, who afterwards planted in the "East, much less of Noah himself; but of *a great colony* "*of them who, when the East was much peopled, chose to* "*go Westward.*" The learned Wells, among those on the other side, thoroughly sensible of the simplicity and unbroken continuity in the intention of the narrative, fortifies himself with some plausible authorities, and then renders the passage "*towards the East.*" But, here is an opposition of senses so truly diametrical, that each must destroy the other in the confidence of every wary and critical reader. There still remains, however, the more obvious and primary signification of the term above stated; which, though not employed (that I am aware of) by any of the *modern versions*, will relieve us from all embarrassment. That interpretation, adopted by some *ancient*, and amongst these by some of

found in many languages: the ὀψὲ, *evening* or *sun-set* of the Greek, is derived from ὀπίσω, *behind*. In the Welsh, the right-hand is called the *South-hand*, and the left-hand the *North-hand*. In the Mandingo language, the term used to express the South, signifies the *right-hand*. (PARK'S *Travels*, Vocab. p. 370.) "Copiosius hoc de argumento (adds "Michaelis) egit pater meus in *Dissertatione de antica et postica, dextera* "*et sinistra, apud Hebræos;* quam, ut plures alias, multis accessionibus "manuscriptis ditatam mihi reliquit: (utinam edendi se offerret occasio!)" Ibid.

the *weightiest authorities*, renders מקדם simply "*ab initio*; "*olim, in principio—first, at first, originally*;" thus, using that sense which the Septuagint declined. "Sic Aquila "(observes Pole), Hieronymus, Onkelos, et Jerusal. in "Bochart. Phaleg. Sic מקדם sumitur Hab. i. 12.— "Syri απ' αρχης 1 Joh. ii. 24. vertunt מן קדים; ut sensus "sit, 'Cùm OLIM, *vel* INITIO, *proficiscerentur homines, in-* 'venirent convallem,' &c. Et locus ex historia præcedenti "subintelligendus est. Sic indicatur, *hanc fuisse* ANTI- "QUISSIMAM *et* CELEBERRIMAM *profectionem nempe* "OMNIUM HOMINUM[1].—Thus, the passage will signify; 'When *mankind* FIRST PROCEEDED FORTH, (from the 'cradle of the renovated race,) *they found a plain*,' &c.; "the place *from whence* they proceeded, being known "from the foregoing history. So that it is shewn—*that* "*this was that* MOST ANCIENT *and* CELEBRATED *pro-* "*gress, namely of the* WHOLE *of mankind then existing*."

That this is the true and legitimate meaning of the text, will amply declare itself if we consider the *authorities* by which it is supported. Whilst the *Jews of Alexandria* fell into the error which has occasioned so much perplexity in a plain and consistent narrative, the *Jews of Asia* carefully preserved its genuine import[2]. The old Chaldee paraphrase, whose principal value consists, (says Kennicott,) especially in "the Pentateuch, in its greater "authority, on account of its greater age, and the greater "accuracy and closeness with which it was composed; "which renders it of great use to assist in the recovery of "such readings as are lost, and in the explanation of such "as are *difficult or obscure*[3];" thus expounds the pas-

[1] *Synopsis.* in loc.

[2] It will be seen in 2 Maccabees, i. 1 and 18, that "*the Jews which* "*are at Jerusalem and in the land of Judea*," were accustomed to write with authority to "*the Jews that are throughout Egypt*."

[3] *Dissertations on the Heb. Text*, vol. ii. p. 220, 221.

sage: "*And it came to pass, when they* FIRST JOUR-
"NEYED[1]—בקדמיתא, *and had found a plain in the land of*
"*Babylon,*" &c. The learned Jewish historian, Josephus, corroborates this interpretation by his traditional relation of the family of Noah, their movements, and final dispersion; a relation, which is utterly irreconcilable with the interpretation assumed by the Septuagint, but in the strictest harmony with that of the Chaldee Paraphrast. After having stated that the ark, on the retreat of the waters, was lodged upon the heights of Armenia, and having adduced various popular and local testimonies in confirmation of that event; he gives the following summary account of the *first transactions* of the new race: "The three sons of Noah, Semas, Ja-
"phethas, and Chamas, were the first who, descending
"from the mountains, made their habitations in the
"plains. And, when the rest, who dreaded the low
"countries from the apprehension of another flood, were
"extremely averse to abandon the heights, they per-
"suaded them to take courage and to follow their
"example; *and, the plain in which they* FIRST *esta-*
"*blished themselves is called Senaar*[2]." In this relation, Josephus manifestly proves in what sense he understood the term מקדם in this place; and he as plainly shews, that he was totally unacquainted with any such *intermediate Eastern roving* as our common version, following the

[1] See also above, p. 238, and *note* 1; where, in Genesis, ii. 8, the Asiatic Jews render מקדם by מלקדמין — *à principio*, but the Alexandrian Jews by, κατ' ανατολας, *versus Orientem*. Aquila renders it by, απ' αρχης; Theodoret by, εν τοις πρωτοις; Symmachus by, εκ πρωτης; Jerom by, *ab exordio*. The first word of Genesis in the Hebrew—בראשית, "*in the beginning*," is rendered in the Chaldaic dialect—בקדמין.

[2] και το μεν πεδιον εις ὁ ΠΡΩΤΟΝ αυτους κατωκισαν καλειται Σεννααρ. *Ant. Jud.* lib. i. cap. 5.

Septuagint through the Vulgate, would lead us to *suppose*. This testimony of a learned Jew of Jerusalem, well skilled in his native tongue[1], is of the first importance. Philo, whose skill in the Hebrew is not so well established, cannot, though a Jew, be opposed as equal authority here, since he appears to follow implicitly the consecrated version of his native city, Alexandria; on which account, Kennicott considers his testimony as important only "in ascertaining the readings of the *Greek* "*version*[2]."

The Persian Targum, which Walton has printed in the fourth volume of his Polyglott Bible, interprets the passage with the same sense as the Chaldee paraphrase and Josephus. "The whole people of the earth were of one "speech and of one form of words; and, *after they had* "*removed their habitation*, they found a valley in the land "of Shinaar, and settled themselves there[3]." The character of this Targum, is thus given by Walton in his *Prolegomena*: "The Christian reader will easily per-"ceive, that great benefit may be derived from collating "this paraphrase with the other versions; since, for the "most part, it is happy in expressing the Hebrew text, "and, by its agreement, confirms the true sense of words "and passages."

In the natural exposition of the terms of the record presented by these several authorities, we perceive the perfect consistency of the great historian; and the harmonious connexion of the successive parts of his narrative, in Gen. viii. 4, ix. 20, x., and xi. 1, 2. For, in the first of these, he specifies the place in which the fathers

[1] See above, vol. i. p. 173, and *note* 3.

[2] *Dissert.* vol. ii. p. 220.

[3] "Fuit universus populus terræ unius sermonis et verborum unius-"modi: et *postquam removissent mansionem suam*, invenerunt vallem in "terra Shinaar, et resederunt ibi." *Polygl. Walton.* tom. iv.

of the future race landed from the ark and formed their *first establishment*:—in the second, he represents the beginning of their *agricultural exercises* in the new soil which they occupied:—in the third, he enumerates the *first families* issuing from the sons of Noah, and takes occasion to advert to the *eventual residences* of their descendants:—and, in the last, he proceeds to record their *first removal from the primitive patriarchal seat*.

If, therefore, we take a general review of the history before us, we shall be not only authorised, but directed to infer: That Noah and his sons first established themselves on the high lands of Armenia, where they employed themselves in cultivating a fertile soil, and in tending the cattle which had been saved in the ark. That they there revived the arts of domestic and social life, and imparted to the new race the experimental knowledge which for so many ages had guided the former race. There, they moreover adapted to the new climate and new position into which they were thrown, the indications of practical astronomy by which the *seasons of time* had been prescriptively observed. From that centre, as their numbers increased and grew to manhood, the borders of the neighbouring regions could not have failed to be explored, both on the northern side of the mountains, towards the fruitful territories but variable climate of Georgia; and on the southern side, towards the sultry plains but clear and serene atmosphere of Mesopotamia. Allured at last, by the temperature of a more southern latitude, to quit their primeval seats and throw themselves into the great unknown wilderness of Asia nearer to the sun, they took *the stream of Euphrates* for their guide, according to the ordinary and natural proceeding of persons who explore extensive and unknown regions, following its left or eastern and northern bank; which river, "rising in the Armenian mountain, runs "first in a direction South; then, *bending its course*

"towards the East, it passes through the middle of "Babylon, and discharges its rapid flood into the Persian "sea[1]." This is that "*circuitous course*," determined by the *direction of the stream*, by which, proceeding from *Armenia* — ἡ χωρα Αρμενιας, according to the corrupted tradition reported by Syncellus from Berosus, they arrived at last at the site of the afterwards famous *Babylon* — ΠΕΡΙΞΙ πορευθηναι εις Βαβυλωνιαν[2]. Here they engaged in the erection of that great and memorable fabric from which the Master of the Earth caused them to desist, and, abandoning their first purpose of *inseparable union*, to separate and disperse themselves "*from* "*thence*," with *multiplied languages* simultaneously and divinely imparted, "*upon the face of the whole earth*:" of which wonderful dispensation, the *Christian* holds a secure and irrefragable testimony in the coordinate and correspondent dispensation of a supernatural *gift of languages*, imparted at the Sacred Epocha from which he dates his ordinary computation of Time; a testimony, which summarily defeats the impotent ingenuities of some over-confident theorists, who would attempt to *deduce all languages, by gradual dialectic process, from One Parent-Tongue.*

[1] ——— αιπυς ῥοος ἑλκεται Ευφρηταο,
ὁς δηποι πρωτος μεν απ᾽ ουρεος Αρμενιοιο
μακρος επι νοτον εισι, παλιν δ᾽ αγκωνας ἑλιξας
αντην ηελιοιο, μεσην Βαβυλωνα περησας
Περσιδος εις ἁλος οιδμα θοην απερευγεται αχνην.

DIONYS. *Perieget*. 797—802.

[2] SYNCELLI *Chronogr*. p. 24. D.—*Babylonia*: anciently *Shinar*, שנער, in the Greek, Σεννααρ; a name probably formed from שני, *shene—two*, and נהר, *nahar—river*, by an usual change of the aspirate (D. LEVI, *Ling. Sacr*. p. 11, 12.); signifying, *bifluvialis*, *interamnis*, *meso-potamia*, the country *between the two rivers*, *Euphrates and Tigris*, and answering to the *Aram* נַהֲרַיִם, or, *Syria of the two rivers*, in Gen. xxiv. 10. Deut. xxiii. 5, &c.

With respect to the primitive patriarchal seat of ARMENIA, and its bordering territories—"This whole "country (says a modern writer) is so extremely beau- "tiful, that fanciful travellers have imagined that they "had here found the *situation of the original Garden* "*of* EDEN. The hills are covered with forests of "oak, ash, beech, chesnuts, walnuts, and elms, en- "circled with vines growing perfectly wild, but pro- "ducing vast quantities of grapes. From these, is "annually made as much wine as is necessary for the "yearly consumption; the remainder, are left to rot on "the vines. Cotton grows spontaneously, as well as the "finest European fruit-trees. Rice, wheat, millet, hemp, "and flax, are raised on the plains, almost without cul- "ture. The valleys afford the finest pasturage in the "world; the rivers are full of fish; the mountains abound "in minerals; and the climate is delicious; *so that nature* "*appears to have lavished on this favoured country every* "*production that can contribute to the happiness of its* "*inhabitants*[1]." It will be pertinent to observe here; that although Tournefort, who visited these parts at the beginning of the last century, flippantly affirmed; "I "don't *see* where the Dove which went out of the "Ark could *find* an Olive-Branch, if the Ark be sup- "posed to have rested upon Mount *Ararat*, or any "of the mountains of *Armenia*; for, this sort of trees "*is not found hereabouts*[2]:" it is incontestable, that the *olive* was a *native plant* in the neighbourhood of Ararat, not only as late as the days of Strabo[3] who was born

[1] *Memoir of a Map of the Countries between the Black Sea and the Caspian*, p. 46.

[2] *Voyage to the Levant*, vol. ii. p. 251.

[3] φησι δε και ελαιας—"*it produces also olives.*" STRABO. *Geogr.* (Armenia) lib. xi. p. (528.) 800 A.

in Armenia, and who flourished about the time of Christ, but also, many centuries afterwards. This is manifest, from the later Armenian geographer; who, describing the province on the north-east of Ararat, says, "Utia is situated on the eastern bank of the Araxes, "between Arsacha and the river Cyrus or Kur:—*olives* "*and cucumbers grow here*[1]." This writer is supposed, by the learned La Croze, to have lived in the ninth or tenth century of the Christian era[2]. But, we have much later testimony respecting that divinely recorded production; although Tournefort was so unlucky in his inquisition, I am favoured with the assurance of Sir William Ouseley, that he witnessed the vegetation of the *olive-tree* near *Ararat*, in his recent journey through Armenia.

It will be easy to perceive, from the preceding topographical description, how readily a confusion of the *seats of the Two First Parents* might have originated, and have become established, in an uncritical age and nation. Such a district as has been described, would have been called by the ancient Greek writers παραδεισος, *Paradisus;* a term assumed by them from the *Persians* (Jul. Poll. *Onomast.* lib. ix. cap. 3. § 13). Xenophon, in his tract on *Domestic Administration*, makes Socrates say—"besides these things, care is taken "that wherever the king resides, or to whatever parts "he may go, there shall be *gardens, such as are* "*called Paradises*—κηποι, οἱ παραδεισοι καλουμενοι—*full* "*of all good and beautiful productions that the earth* "*will bring forth.*" J. Pollux connumerates "*gardens,* "*Paradises, groves*"—κηποι, παραδεισοι, αλση. (Lib. i.

[1] Moses Chorenensis, *Geographia*, p. 361.

[2] *Thes. Epist.* tom. iii. p. 281.

cap. 32[1].) The original Persian word פרדס—*Pardes*, occurs in Nehem. ii. 8, also in Eccles. ii. 5, and Song of Solom. iv. 13. In the first of these, where our version renders it "*forest*," the Greek has παραδεισου, *Paradise;* in the second also, where we translate "*orchards*," the Greek renders literally παραδεισους, *Paradises*. Now, this same word is adopted, and consecrated, by the Greek translators of Genesis, to express the "*Garden* "*in which the Lord God made to grow every tree that* "*is pleasant to the sight and good for food;*" from whose translation we have derived the word *Paradise*, which term we employ to denote, by excellence and exclusively, the *Garden of Eden*. Hence, that "*Paradise*" or *Garden* would have been readily assumed and believed, from its name, to have pertained to Asia, the native country of פרדסים—*Pardesim*, or *Paradises*[2]. The Chaldee Paraphrast thus interprets the whole clause in Genesis—"and the Lord God had planted a *garden* in a *place* "*of delight*, from the beginning[3]:" the Hebrew word *Eden*—עדן, signifying *oblectatio, voluptas, deliciæ*—*pleasure, delight*. Hence, our Lord was pleased to employ the term "*Paradise*," to convey to his auditors a *secure and familiar sense* of the *blissful condition* into which faithful spirits immediately pass on their separation from the body[4]. The authors of the *Hiero-Lexicon*, have briefly stated a question which arose, in the early Christian ages, out of the introduction of the term *Paradise* by the Septuagint translators: "Some contended,

[1] See Wetstein's long and learned note on παραδεισος, in Luke, xxiii. 43, and Parkhurst's *Heb. and Gr. Lex.*

[2] "GENNAT ADN ou EDEN: le *Jardin d'Eden* ou le *Paradis ter-*"*restre*.—Les Orientaux comptent *quatre Paradis dans l'Asie*, à savoir, "en Syrie, en Chaldée, en Perse, et à Samarcand." D'HERBELOT, *Biblioth. Orient.* p. 352. fol.

[3] See above, p. 238.

[4] Luke, xxiii. 43.

" from Xenophon, Plutarch, Philostratus, and others, " that the *Paradise* implies a place of immense extent, " capable of sustaining a great variety of animals for the " chase.—Others maintained, that it was a place adorned " with beautiful and fragrant plants, adapted and pro- " portioned for a delightful dwelling of man.—Chry- " sostom (*Hom.* 13), Theodoret (*Quest.* 25 *in Gen.*), and " Jerom (*de dictionibus Hebraicis, verb. Eden*), affirm, " that Eden was not the Paradise, but the region and " territory in which the Paradise was planted :—Augustine " (*lib. viii. in Gen. cap.* 10) observes, that the place " could not be of small extent which was irrigated by so " copious a source.—Where it existed, is a question " variously determined by various writers." (v. *Paradisus.*)

With respect to that EDEN, and its PARADISE; it is thoroughly manifest from the Mosaic text[1], that *Eden* was a *delightful* district of the *first earth*, watered throughout its extent by *four converging streams*: that, in a selected part of that district, God had from the first prepared a *Garden* or *Paradise*, bountifully contrived for the dwelling of the first parents and the cradle of the first human race; from whence, if they had kept their station, they might have extended themselves in that same Eden: but, it is moreover manifest, that the four streams did not distribute their waters *beyond the limits of Eden*; for, they *united at its border*, and from thence flowed forward *in a single channel*. The ancient Hebrew ignorance of general geography, and the consequent inversion of the order of the historian's description, before observed, are the sources of the erroneous interpretations which still keep their hold in our latest English annotations on this passage of the record. Josephus, explained

[1] See above, p. 239.

the geographical gloss to signify; "that a river flowed in a "circuit round the Garden, and then *divided itself* to four "parts (μερη); that *Phison*, which was the *Ganges*, "discharges itself into the sea in India; Euphrates and "Tigris, into the Persian gulf; and that *Gihon*, which "flows through Egypt, is the same river that the "Greeks call *the Nile;*" (*Ant. Jud.* lib. i. cap. 1. § 3.); and Ambrose, in the fourth century, admitted this exposition without suggesting an objection[1]. This extreme ignorance of geography, continued to prevail as late as the fifteenth century. In a MS. survey of the maritime defences of the Ottoman Power, secretly made by the order of Henry V. in 1422, with the design of attempting the conquest of the Holy Land, the noble and enterprising author[2] thus makes his report of the *course of the Nile:* "Memoire que la riviere du Nil est tres "douche eaue, et tres saine, et queurt *(court)* doucement, "non pas trop rade, *et vient de devers les parties d'Inde* "*du Paradis Terrestre, come on dist;* et passe ou long "de Egipte, et vient par devant Babillonne passer a iii "milles du Kaur *(Kaire)*, et passe devant Boulac[3]." From this inveterate ignorance of geography, sprang the conceit of *a river which split its stream, in the course of its descent, into four distinct and independent rivers.* As it was at length perceived, that these could not possibly be the *Ganges, Euphrates, Tigris,* and *Nile,* it was loosely

[1] "Hæc igitur quatuor sunt flumina; hoc est, *Phison* secundum "Hebræos, *Ganges* autem secundum Græcos, qui fluit contra Indiam. "*Geon* autem *Nilus*, qui circuit terram Ægypti et Æthiopiam. *Meso-*"*potamia* autem dicitur quod Tigris et Euphrates intercluserint eam, eo "quod *inter duo hæc flumina* constituta sit." *De Paradiso*, cap. 3.

[2] Gilbert de Lannoi, Ambassador from the Duke of Burgundy to Henry; afterwards, Knight of the *Golden Fleece.*

[3] For an account of this MS., see the first *Annual Report* of the *Royal Society of Literature*, p. 10, 11.

and irreflectively assumed, that *they must therefore be some other four rivers* in, or in the neighbourhood of, Armenia; but, it was not perceived, however extraordinary the imperception may appear, that they *could not, by the order of nature,* i. e. *of creation, be any four rivers at all*[1].

[1] See above, p. 237, 241.

END OF THE SECOND VOLUME.

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